

ANSWERS

EXERCISE 1.1

- (ii) and (iv) are sets; all others collections are not sets because these collections are not well defined
- (i) $\{1, 3, 5, 7, \dots\}$; $\{x \mid x = 2n - 1, n \in \mathbf{N}\}$
 (ii) $\{0, 2, 4, 6, \dots\}$; $\{x \mid x = 2n, n \in \mathbf{W}\}$
 (iii) $\{\dots, -4, -2, 0, 2, 4, \dots\}$; $\{x \mid x = 2n, n \in \mathbf{I}\}$
 (iv) $\{1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72\}$; $\{x \mid x \text{ is a factor of } 72\}$
 (v) $\{1, 8, 27, 64\}$; $\{x : x = n^3, n \in \mathbf{N} \text{ and } n < 5\}$
- (i) $\{-6, -3, 0, 3, 6, \dots, 27\}$ (ii) $\{12, 14, 15, 16, 18, 20, 21, 22, 24\}$
 (iii) $\{0, 12, 24, 36, 48, 60, 72, 84, 96\}$ (iv) $\{49, 58, 67, 76, 85, 94\}$
 (v) $\{-3, -1, 1, 3, 5, 7\}$ (vi) $\left\{\frac{1}{3}, \frac{3}{5}, \frac{5}{7}, \frac{7}{9}, \dots, \frac{21}{23}\right\}$
 (vii) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$ (viii) $\{0, 1, 2, 3, 4, 5\}$
 (ix) $\{0, 1, 2, 3, 4, 5, 6\}$
- (i) $\{x : x = \frac{1}{n}, n \in \mathbf{N} \text{ and } n < 10\}$
 (ii) $\{x : x = \frac{n}{n+2}, n \text{ is odd natural number}\}$ or $\{x : x = \frac{2n+1}{2n+3}, n \in \mathbf{W}\}$
 (iii) $\{x : x = \frac{1}{n^2}, n \in \mathbf{N} \text{ and } n \leq 10\}$ (iv) $\{x : x = \frac{1}{2^n}, n \in \mathbf{W} \text{ and } n \leq 8\}$
 (v) $\{x : x = 5p, p \in \mathbf{I} \text{ and } -2 \leq p \leq 20\}$ (vi) $\{x : x \in \mathbf{N} \text{ and } x \text{ is a factor of } 48\}$

EXERCISE 1.2

- (i) infinite set (ii) infinite set (iii) finite set; 0
 (iv) finite set; 12 (v) finite set; 7 (vi) finite set; 6
 (vii) infinite set (viii) infinite set (ix) finite set; 11
- (i) matches (c) (ii) matches (a) (iii) matches (d)
 (iv) matches (b)
- $\{1, 2, 3, 4, 5\}$ 4. $\{2, 3\}$ 5. $A = B$
- (i) false (ii) false (iii) false
 (iv) false (v) true (vi) true
 (vii) false; for example, let $A = \{1, 2\}$ and $B = \{2, 3\}$
 (viii) false; ϕ has no proper subset (ix) true
 (x) false; for example, infinite set \mathbf{N} has a finite subset $\{1, 2\}$
- (i) false (ii) false (iii) true (iv) true
 (v) false (vi) true (vii) false (viii) true
- (i) $A \leftrightarrow B; A \neq B$ (ii) $A \leftrightarrow B; A \neq B$
 (iii) $A \leftrightarrow B; A = B$ (iv) A is not equivalent to B
- (i) false (ii) true (iii) false (iv) false
 (v) false (vi) true
- There are 8 subsets— $\phi, \{0\}, \{5\}, \{10\}, \{0, 5\}, \{0, 10\}, \{5, 10\}$ and $\{0, 5, 10\}$. First seven are proper subsets and the last is improper subset

CHECK YOUR PROGRESS

1. (i) $\{-1, 4, 9, 14, \dots, 39\}$ (ii) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$
 (iii) $\left\{-\frac{1}{2}, \frac{1}{3}, \frac{3}{4}, 1\right\}$ (iv) $\{\dots, -4, -3, -2\}$
2. (i) $\{x : x = 2n, n \in \mathbf{I}, -5 < n < 6\}$ (ii) $\{x : x \text{ is a prime number}, 10 < x < 32\}$
3. (i), (ii), (iii), (viii), (ix) are correct and (iv), (v), (vi), (vii) are incorrect
4. (i) False, for $\{0\}$ is not empty set
 (ii) False, for ϕ is a subset of ϕ
 (iii) True (iv) False, this collection is not well defined
 (v) False, for it is infinite set (vi) False, for $n(A) = 7$
 (vii) True, for $A = \{99\}$ (viii) True, for $P = \phi$ (ix) True
5. (i) False (ii) True
6. (i) False (ii) False (iii) False (iv) True
7. (i) False (ii) True (iii) False (iv) False (v) False
 (vi) False (vii) True (viii) True (ix) False (x) True
8. There are 8 subsets of P — ϕ , $\{E\}$, $\{A\}$, $\{I\}$, $\{E, A\}$, $\{E, I\}$, $\{A, I\}$ and $\{E, A, I\}$. First seven are proper subsets and the last is improper subset

EXERCISE 2.1

1. (i) $\{0, 1, 2, 3, 4, 5, 6\}$ (ii) $\{4\}$
 (iii) $\{5, 6\}$ (iv) $\{0, 1, 2, 3\}$
2. (i) $\{0, 1, 2, \dots, 8\}$ (ii) $\{4, 5\}$
 (iii) $\{0, 1, 2, 3\}$ (iv) $\{6, 7, 8\}$; Yes
3. (i) $\{I, N, T, E, G, R, Y, C, K, O\}$ (ii) $\{I, N, E, R, G\}$
 (iii) $\{T, Y\}$ (iv) $\{C, K, O\}$
4. (i) $\{1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 24, 30\}$
 (ii) $\{1, 2, 3, 6\}$ (iii) $\{4, 8, 12, 24\}$
 (iv) $\{5, 10, 15, 30\}$
5. (i) $\{5, 9\}$ (ii) $\{1, 2, 3, 5, 7, 9\}$
 (iii) $\{1, 2, 3, 4, 6, 7, 8\}$ (iv) $\{4, 6, 8\}$
 (v) $\{1, 2, 3, 7\}$ (vi) $\{\}$
 (vii) $\{1, 2, 3, 5, 7, 9\}$ (viii) $\{1, 2, 3, 5, 7, 9\}$
7. 6 8. (i) 28 (ii) 8 (iii) 12
9. (i) 25 (ii) 28 (iii) 8 (iv) 29 (v) 17 (vi) 4
10. (i) 17 (ii) 21 (iii) 33

EXERCISE 2.2

1. (i) $\{0, 1, 2, \dots, 12\}$ (ii) $\{8, 0, 5\}$ (iii) $\{0, 5\}$
 (iv) $\{2, 7, 8, 9, 10, 11, 12\}$ (v) $\{8, 10\}$ (vi) $\{7, 8, 11\}$
 (vii) $\{3, 4, 6\}$ (viii) $\{2, 4, 6, 9, 12\}$ (ix) $\{2, 9, 12\}$
2. (i) $\{0\}$ (ii) $\{1, 2, 7\}$
4. (i) 35 (ii) 17 (iii) 13
5. (i) 35 (ii) 40 (iii) 19 (iv) 10
6. 8 7. (i) 37 (ii) 13
8. (i) 6 (ii) 8 9. 13

CHECK YOUR PROGRESS

- $A' = \{x : x \in \mathbf{N}, x = 1 \text{ or } x \text{ is a prime number less than } 25\}$
 $A' = \{1, 2, 3, 5, 7, 11, 13, 17, 19, 23\}$
- (i) $\{1, 2, 3, 4, 5, 6\}$ (ii) $\{1, 2, 3, 4, 10, 11, 12\}$
 (iii) $\{5, 6, 7, \dots, 12\}$ (iv) $\{7, 8, 9\}$ (v) $\{10, 11, 12\}$
 (vi) $\{5, 6\}$ (vii) $\{1, 2, 3, 4\}$ (viii) $\{1, 2, 3, 4\}$
- (i) 24 (ii) 24
- (i) 24 (ii) 9 (iii) 50 (iv) 26
- $45^\circ, 45^\circ, 90^\circ$ 7. 30 8. 20%

EXERCISE 3.1

- (i) 1 (ii) 0; No
- 30, 33, 70, 77, 37, 73
- (i) 8, 9, 80, 90, 89 (ii) 8, 9, 80, 88, 90, 89
- 10378; 87310 6. 98765, 10234
- (i) 100002 (ii) 999987
- (i) 88310; 10038 (ii) 77530; 30057
- (i) 999287; 100203 (ii) 996987; 106002
- 9639 11. 1064
- 6, -5 or -5, -4
- (i) True (ii) True (iii) True (iv) False
- (i) 18 (ii) 5 (iii) 40 (iv) -27

EXERCISE 3.2

- $3^3 \times 37$ 2. (i) $2^2 \times 3^2 \times 5 \times 7 \times 11$ (ii) $2 \times 5 \times 11^2 \times 23$ (iii) $2^6 \times 7^3$
- 3 4. (i) 1680 (ii) 5040 5. 1673 6. 6165
- 9720 8. 10080 9. (i) 6 (ii) 16 10. 17
- (i) co-prime (ii) not co-prime (iii) co-prime
- 15 litres 13. (i) 40 (ii) 2 m
- 2574 15. 126 16. 210

EXERCISE 3.3

- (i) $3\frac{2}{7}$ (ii) $7\frac{7}{15}$ (iii) $-11\frac{79}{105}$ 2. (i) $\frac{31}{7}$ (ii) $\frac{632}{47}$ (iii) $-\frac{45}{8}$
- (i) $\frac{7}{8}$ (ii) $\frac{3}{5}$ (iii) $-\frac{3}{14}$ (iv) $-\frac{12}{5}$
- (i) $\frac{78}{96}, \frac{68}{96}, \frac{69}{96}$ (ii) $\frac{30}{60}, \frac{40}{60}, \frac{45}{60}, \frac{48}{60}, \frac{50}{60}$ 5. (i) $\frac{5}{12}, \frac{9}{16}, \frac{3}{4}$ (ii) $\frac{2}{3}, \frac{9}{13}, \frac{5}{7}, \frac{5}{6}$
- (i) $\frac{37}{45}, \frac{11}{15}, \frac{13}{18}$ (ii) $\frac{13}{18}, \frac{17}{24}, \frac{7}{12}, \frac{8}{15}$
- (i) $\frac{5}{8}$ (ii) $\frac{10}{13}, \frac{17}{21}$ (iii) $\frac{11}{17}, \frac{7}{12}, \frac{10}{19}$
- (i) $4\frac{1}{3}$ (ii) 1 9. 20 10. (i) $1\frac{53}{70}$ (ii) $\frac{3}{1400}$ 11. 1 metre 12. $\frac{5}{12}$
- 20 14. 21000 15. $\frac{7}{16}$; ₹ 8160 16. 16, 40
- ₹ 200000 18. 180 19. 80

EXERCISE 3.4

1. (i) $\frac{5}{8}$ (ii) $\frac{121}{40}$ (iii) $\frac{509}{125}$
2. (i) 0.031 (ii) 13.00057 (iii) 0.875 (iv) 7.3125
 (v) $2.8\dot{3}$ (vi) $0.0\overline{81}$ (vii) $0.29\dot{5}4$ (viii) $0.\overline{571428}$
3. (i) 0.3, 0.303, 0.33, 3.03 (ii) 0.6034, 0.6304, 0.634, 0.643
4. (i) 40.1507 (ii) 6.5762 (iii) 0.02763 (iv) 30.0112 (v) 17 (vi) 4.0415
5. (i) 4.32 (ii) 2.625 (iii) 750 6. (i) $2\frac{10}{13}$ (ii) 14.075 kg
7. (i) 3.1429 (ii) 3.143 8. 0.1042 9. 4
10. (i) ₹ 54600 (ii) ₹ 63750 (iii) ₹ 28.00 (iv) 4.36 m
 (v) 63.90 m (vi) 0.076 kg (vii) 3.45 m

EXERCISE 3.5

1. $\frac{73}{126}, \frac{4}{9}, \frac{73}{126}, \frac{5}{7}$ 2. $\frac{43}{144}, \frac{3}{8}, \frac{43}{144}, \frac{2}{9}$ 3. 5.15, 5.3, 5.45
4. (i) $3\sqrt{2}$ (ii) $7\sqrt{3}$ (iii) $2\sqrt{3}$ (iv) $10\sqrt{6}$ (v) $\sqrt{5}$ (vi) 15
5. (i) $\frac{2\sqrt{10}}{5}$ (ii) $\frac{3+\sqrt{2}}{7}$ (iii) $4(2-\sqrt{3})$ (iv) $\frac{5+\sqrt{13}}{4}$
 (v) $3\sqrt{2} - 1$ (vi) $\sqrt{3} + \sqrt{2}$ (vii) $4\sqrt{2}(\sqrt{5}+\sqrt{3})$ (viii) $4 - \sqrt{15}$
 (ix) $\sqrt{2} - 1$ 6. (i) $3\frac{5}{11}$ (ii) $\frac{16\sqrt{13}}{3}$
7. (i) $2\sqrt{3}, \sqrt{15}, 4, 3\sqrt{2}$ (ii) $3\sqrt{7}, 6\sqrt{2}, 5\sqrt{3}, 4\sqrt{5}, 10$
8. $\sqrt{6}$ 9. $\sqrt{5}, \sqrt{6}$ 10. $\sqrt{13}, \sqrt{14}, \sqrt{15}$

EXERCISE 3.6

1. (i) 26 (ii) 32 (iii) 86 (iv) $3\frac{1}{11}$
 (v) $4\frac{1}{6}$ (vi) 1.4 (vii) 0.08 (viii) 0.65
2. (i) 9 (ii) $\frac{39}{110}$ (iii) 0.5 3. 57
4. (i) 232 (ii) 462 (iii) 2053
5. (i) 4.29 (ii) 2.403 (iii) 30.58 6. (i) 1.41 (ii) 1.4
7. 5.20 8. (i) 25.41 (ii) 10.37 (iii) 2.34
9. 15.9 10. 1.73; 3.73 11. (i) 3 (ii) 2 (iii) 2
12. (i) 3 (ii) 2 (iii) 6 13. (i) 15 (ii) 98 (iii) 205
14. (i) 2 (ii) 98 (iii) 100 15. 998001
16. (i) 24 (ii) 63 (iii) $\frac{4}{11}$ (iv) $1\frac{10}{13}$ (v) 0.15 (vi) 2.7
17. 3; 27 18. 12; 9

CHECK YOUR PROGRESS

1. 0, 5, 9, 50, 90, 59, 95, 590, 950, 509, 905
2. 100141 3. (i) 80 (ii) -2
4. $2^5 \times 5^5$ 5. 1735 6. 10080

7. 108 8. 84 9. 124 10. No
11. (i) $\frac{3}{4}, \frac{11}{18}, \frac{7}{12}$ (ii) $\frac{11}{12}, \frac{3}{4}, \frac{7}{10}, \frac{5}{9}$ 12. $\frac{2}{3}, \frac{1}{2}, \frac{3}{7}$
13. $1\frac{23}{45}$ 14. 300 grams 15. 360 runs
16. (i) 2059.307 (ii) 37.00709 (iii) 3.425 (iv) 0.0208 (v) $0.\overline{027}$
17. (i) 0.05 (ii) -0.03 18. $\frac{7}{24}, \frac{13}{48}, \frac{1}{4}, \frac{13}{48}, \frac{7}{24}, \frac{1}{3}$
19. (i) $3(2\sqrt{3} + 1)$ (ii) $2(2\sqrt{2} - \sqrt{3})$ 20. $\sqrt{10}, \sqrt{11}, \sqrt{12}$
21. $\sqrt{21}, \sqrt{22}$ 22. (i) 98 (ii) $5\frac{1}{7}$ (iii) 0.41
23. (i) 427 (ii) 0.0051 (iii) 0.137 24. 2.24; 0.84 25. 14 26. 92 27. 1024
28. (i) 84 (ii) $1\frac{4}{21}$ (iii) 2.6 29. 637; 6.

EXERCISE 4.1

1. (i) 1 : 1 (ii) 120 : 1 (iii) 1 : 8 (iv) 40 : 3
2. (i) 5 : 9 (ii) 7 : 11 (iii) 4 : 3 : 10 (iv) 30 : 14 : 21
3. 1 : 12 4. (i) 3 : 5 (iii) 0.9 : 1 (iii) $\frac{1}{2} : \frac{1}{3}$ (iv) 3.5 : 4.5
5. (i) 5 : 12, 9 : 16, 3 : 4 (ii) 3 : 8, 9 : 14, 5 : 7, 20 : 21
6. Science 7. ₹ 300, ₹ 750 8. ₹ 20, ₹ 30, ₹ 40
9. ₹ 100, ₹ 160, ₹ 550 10. 36 : 65 11. 4 : 5
12. (i) 42 : 35 : 40 (ii) 8 : 12 : 33 (iii) 15 : 12 : 14
13. A = 14, C = 35 14. 4 : 3 : 2 15. ₹ 189 16. ₹ 935
17. 80, 128 18. ₹ 900; ₹ 315, ₹ 360
19. ₹ 256, ₹ 384, ₹ 672 20. ₹ 2150, ₹ 1935, ₹ 3010 21. 54, 90, 144 22. 301
23. 60 kg 24. 10, 20 25. 18, 20 26. 14

EXERCISE 4.2

1. (i), (ii) and (iii) are true 2. (ii) and (iii) are in proportion
3. (i) 40 (ii) $1\frac{3}{7}$ (iii) 2.8 4. (i) 45 (ii) 5 pencils
5. (i) 13.5 (ii) $\frac{11}{7}$ (iii) ₹ 137.5 (iv) 7 m
6. Yes 7. (i) 9 (ii) 4.05 (iii) $21\frac{7}{8}$ (iv) 15 paise
8. (i) 12 (ii) $\frac{2}{21}$ (iii) 0.4 (iv) 0.009
9. 20 10. (i) 9.3 (ii) 9.14 (iii) 3.2 11. 1 m 35 cm

CHECK YOUR PROGRESS

1. 41 : 294 2. 1 : 3 3. 11 years 3 months
4. (i) 27 m (ii) 90 m (iii) 3 : 10 5. 57, 95 6. 10 : 9, 20 : 15 : 18
7. ₹ 376, ₹ 564, ₹ 705 8. ₹ 340, ₹ 510, ₹ 1020 9. 625
10. ₹ 36000 per month 11. ₹ 4060 12. $\frac{3}{20}$ 13. ₹ 6.25
14. 1.5 kg 15. 0.14

EXERCISE 5.1

- | | | | |
|-------------|----------------|-------------|-------------|
| 1. ₹ 181.25 | 2. ₹ 35 | 3. 13 | 4. ₹ 1728 |
| 5. 572 | 6. 396 | 7. 30 | 8. 2 hours |
| 9. 16 | 10. 36 minutes | 11. 10 days | 12. 36 days |
| 13. 300 | 14. ₹ 1710 | 15. 12 | 16. 10 |

EXERCISE 5.2

- | | | |
|---|---|---------------------------------|
| 1. $\frac{5}{6}$ th | 2. $4\frac{4}{9}$ days | 3. A gets ₹ 2100, B gets ₹ 1400 |
| 4. 6 days | 5. $5\frac{5}{11}$ days | 6. $7\frac{1}{2}$ minutes |
| 7. $2\frac{1}{2}$ days | 8. $13\frac{1}{3}$ days | 9. 3 days |
| 10. $3\frac{3}{4}$ days | 11. 1 day; A gets ₹ 480, B gets ₹ 160, C gets ₹ 320 | |
| 12. 120 days | 13. 12 days | |
| 14. 8 days; A takes $17\frac{1}{7}$ days, B takes 24 days and C takes 40 days | | |
| 15. 48 hours | | |

CHECK YOUR PROGRESS

- | | | | |
|--|--------------|------------------------------|--|
| 1. 8 | 2. Can't say | 3. ₹ 472.50 | 4. 5 days |
| 5. 30 | 6. 46 days | 7. 50 men | 8. 6 days |
| 9. 12 days | 10. 30 hours | 11. (i) $10\frac{2}{7}$ days | (ii) $\frac{4}{7}, \frac{3}{7}$ (iii) ₹ 2100 |
| 12. $1\frac{1}{3}$ days; 28 gm, 21 gm, 14 gm | 13. 30 days | | |

EXERCISE 6.1

- | | | |
|---------------------------------|---------------------------|----------------------------------|
| 1. 27 km | 2. 3 hours 20 minutes | 3. 6 km/hr |
| 4. (i) 12.5 m/sec | (ii) 150 m/sec | (iii) 1.25 m/sec |
| (iv) 40 m/sec | (v) $\frac{1}{8}$ m/sec | (vi) 1.25 m/sec |
| 5. (i) 72 km/hr | (ii) 5.4 km/hr | (iii) 0.9 km/hr |
| 6. 15 km/hr | 7. 60 km/hr | 8. 11 km/hr |
| 9. $46\frac{2}{3}$ km/hr | 10. $13\frac{1}{3}$ km/hr | |
| 11. 80 km/hr | 12. 45 minutes | 13. $16\frac{2}{3}$ km/hr |
| 14. Rabbit will be 6.5 km ahead | 15. 2 km | 16. 60 km |
| 17. 1 km, 15 minutes | | |
| 18. (i) 10 seconds | (ii) 30 seconds | 19. (i) 54 km/hr (ii) 28 seconds |
| 20. 40 km/hr | 21. 280 m | 22. 540 m |
| 23. (i) 54 km/hr | (ii) 210 m | 24. (i) 90 km/hr (ii) 75 m |

EXERCISE 6.2

- | | | | |
|------------------|----------------|--------------------------|-----------|
| 1. 18 km | 2. 5 hours | 3. 360 km | 4. 12 sec |
| 5. 10.5 sec | 6. (i) 18 sec | (ii) 1 minute 30 seconds | |
| 7. (i) 3 minutes | (ii) 6 minutes | 8. 1.5 km/hr | |
| 9. 1.5 km/hr | 10. 12.5 km/hr | 11. 42 km, 7 hours | |

CHECK YOUR PROGRESS

1. 25 m/sec
2. 60 km/hr
3. 630 km
4. 180 km
5. At 1 p.m., 175 km from Delhi
6. The horse galloped 6 km in 6 minutes and trotted 4 km in 20 minutes.
7. 405 m
8. 36 sec
9. (i) 210 m (ii) 315 m
10. 250 m
11. 800 m
12. 45 km/hr

EXERCISE 7

1. (i) $3\frac{14}{25}$ (ii) $\frac{1}{40}$ (iii) $\frac{1}{6}$ (iv) $\frac{1}{40}$
2. (i) 150% (ii) 45% (iii) 125% (iv) $233\frac{1}{3}\%$
3. (i) 0.75, 75% (ii) 0.625, 62.5% (iii) 0.1875, 18.75% (iv) 0.0875, 8.75%
4. (i) 0.6667, 66.67% (ii) 0.8333, 83.33% (iii) 0.5714, 57.14% (iv) 2.2222, 222.22%
5. (i) 85% (ii) $72\frac{2}{9}\%$ (iii) 116.25%
6. (i) 0.2 (ii) 0.02 (iii) 0.0325 (iv) 0.0007
7. (i) ₹ 13.50 (ii) 1.6 m (iii) $1\frac{9}{16}$ kg (iv) 3.12
8. (i) 25% (ii) 15% (iii) 125% (iv) 150%
9. (i) 20% (ii) 130% (iii) $44\frac{4}{9}\%$
10. (i) 600 (ii) 150 (iii) 1200
11. (i) 78 (ii) 675
12. (i) 260 (ii) 850
13. ₹ 12600
14. ₹ 11000
15. 1650
16. 12.5%
17. 45%
18. 90000; 10%
19. 1280
20. (i) Maths (ii) Hindi (iii) 87%
21. (i) 40% (ii) 60% (iii) 500
22. ₹ 1275
23. 70 kg
24. (i) ₹ 34 (ii) ₹ 24
25. No
26. $16\frac{2}{3}\%$
27. 25%
28. $16\frac{2}{3}\%$
29. 80
30. 600; 40%

CHECK YOUR PROGRESS

1. 29.17%
2. 18.75%
3. $2\frac{1}{12}\%$
4. (i) 10 hours (ii) $9\frac{1}{2}$ hours
5. 550
6. 10%
7. (i) 35% (ii) 600
8. 40
9. ₹ 4320
10. ₹ 14520
11. 38%
12. 8% increase
13. 52%
14. ₹ 180000
15. $11\frac{1}{9}\%$
16. 38%
17. 250%

EXERCISE 8.1

1. (i) Profit 17% (ii) loss 7.5% (iii) loss 11% (iv) profit $8\frac{1}{3}\%$
2. 6.25%
3. 12.5%
4. Profit 12.5%

5. Profit ₹ 20000; 8% 6. $11\frac{1}{9}\%$ 7 (i) $32\frac{4}{7}\%$ (ii) 60
8. Profit $33\frac{1}{3}\%$ 9. Loss 25% 10. Profit 40%
11. (i) ₹ 2548.80 (ii) ₹ 351.50 (iii) ₹ 1680 (iv) ₹ 328.50
12. ₹ 2.25 13. Profit 15% 14. Profit $6\frac{2}{3}\%$
15. ₹ 203 16. ₹ 16200
17. (i) ₹ 500 (ii) ₹ 600 (iii) ₹ 480 (iv) ₹ 5720
18. Loss ₹ 400; 25% 19. Gain 25%
20. 12% 21. ₹ 1631.25 22. ₹ 324 23. 10
24. Loss 1% 25. ₹ 1300 26. ₹ 650 27. ₹ 690

EXERCISE 8.2

1. (i) ₹ 69, ₹ 506 (ii) ₹ 1062.50, ₹ 11687.50
2. (i) ₹ 58.5, 7.5% (ii) ₹ 3990; 14%
3. ₹ 306 4. ₹ 800 5. (i) ₹ 640 (ii) ₹ 512
6. (i) ₹ 1980 (ii) ₹ 1800 7. (i) ₹ 780 (ii) ₹ 975
8. (i) ₹ 2160 (ii) ₹ 1836 (iii) 53%
9. (i) ₹ 2000 (ii) ₹ 1680 (iii) 5%
10. (i) ₹ 450 (ii) ₹ 300 11. 8% 12. Loss 4%
13. ₹ 24453 14. Second option 15. 37%

CHECK YOUR PROGRESS

1. Profit 20% 2. Profit $6\frac{2}{3}\%$ 3. 25% 4. $33\frac{1}{3}\%$
5. 20% 6. (i) ₹ 1127 (ii) ₹ 1428 7. ₹ 87400
8. ₹ 7656 9. (i) ₹ 5400 (ii) ₹ 1350
10. Loss ₹ 1000, 4% 11. ₹ 750 12. ₹ 200 13. ₹ 224
14. (i) ₹ 500 (ii) ₹ 400 15. (i) ₹ 234 (ii) ₹ 260
16. ₹ 5000 17. 14.5% 18. ₹ 180; ₹ 216; 20%

EXERCISE 9.1

1. (i) ₹ 975, ₹ 4975 (ii) ₹ 40, ₹ 1240 (iii) ₹ 688.80, ₹ 3376.80
(iv) ₹ 437.50, ₹ 5437.50 (v) ₹ 272, ₹ 1632
2. ₹ 122.50, ₹ 3797.50 3. ₹ 1260 4. 6.5% p.a.
5. $3\frac{1}{2}$ years 6. (i) ₹ 13000 (ii) ₹ 10000
7. 24% p.a. 8. 12% p.a. 9. 15 years
10. ₹ 119500 11. ₹ 44800 12. ₹ 7500
13. ₹ 6750, $3\frac{1}{3}\%$ p.a. 14. 9% p.a.

EXERCISE 9.2

1. ₹ 1260 2. ₹ 153 3. ₹ 9159.20; ₹ 1159.20
4. ₹ 15972; ₹ 3972 5. ₹ 24334
6. (i) ₹ 1875 (ii) ₹ 50700 (iii) ₹ 2028
7. ₹ 660; ₹ 7986 8. ₹ 5724; ₹ 724 9. ₹ 128

CHECK YOUR PROGRESS

1. ₹ 2080
 2. 25% p.a., 12 years
 3. ₹ 7500
 4. ₹ 2812.50
 5. ₹ 4560
 6. 5 years 4 months
 7. 12.5% p.a., ₹ 5480
 8. ₹ 388.50
 9. ₹ 720

EXERCISE 10.1

1. (i) monomial (ii) monomial (iii) binomial
 (iv) trinomial (v) binomial (vi) binomial
 (vii) multinomial (viii) trinomial (ix) multinomial
2. (i) $-9; p^2q^2r$ (ii) $-\frac{7}{9}; xy^2$ (iii) $\frac{4}{9}; a^2b^2cd$
 (iv) $\frac{3}{4}; \frac{1}{x^2y}$ (v) $\frac{3}{2}; \frac{x^2y}{z}$ (vi) $-\frac{2}{3}; \frac{x^2y}{z}$
3. (i) $-\frac{2}{3}pq^2r^5$ (ii) $\frac{1}{3}p^2qr^5$ (iii) $-\frac{2}{3}p^2qr^4$ (iv) $-2pqr^4$
 (v) $\frac{1}{3}pr^4$ (vi) $-\frac{2}{3}r^5$ (vii) $-\frac{2}{3}p^3q^2$ (viii) p^2qr^3
4. (i) $3abc, -\frac{2}{3}cab, 7bac; -5ab^2, \frac{2}{7}b^2a$ (ii) $7pq^2, \frac{2}{3}q^2p; -3p^2q, -\pi qp^2; \sqrt{5}qp, 4pq$
 (iii) $3x^2yz, -\sqrt{5}yzx^2; \sqrt{7}xyz^2, -\frac{4}{3}z^2xy; \frac{2}{5}y^2xz, 9xzy^2$
5. (i) polynomial; 4 (ii) not a polynomial (iii) polynomial; 5
 (iv) not a polynomial (v) polynomial; 7

EXERCISE 10.2

1. (i) $\frac{9}{2}ab$ (ii) $-x + 4y$
 (iii) $2pq - p^2$ (iv) $-\frac{13}{3}x + \frac{31}{5}y - 3z$
2. (i) $12p^2$ (ii) $-12xy$ (iii) $\frac{26}{21}p^2q^2r$ (iv) $5y^2 + \frac{3}{2}x^2$
3. (i) $x^2 - 4xy - y^2$ (ii) $2x^4 - \frac{4}{3}x^3 - \frac{17}{2}x^2 + 8x - \frac{1}{5}$ (iii) $\frac{59}{30}p - \frac{3}{2}q - \frac{25}{3}r$
4. (i) $3a - 11b + 19c - 6$ (ii) $8x + 10y - 5z + 5$
 (iii) $11x^3 + 2x^2 - 29x + 14$ (iv) $-7ax + by + 16cz$
5. $8x^2 - 4y^2 + 6xy$
6. (i) $-2a + 8b - 20c + 5$ (ii) $4x^2 - xy - 2y^2 + 5$
 (iii) $-p^2 - 9q^2 - r^2 - 9$ (iv) $4m^4 + 3m^3 + 3m^2 - 7m + 9$
7. $2p + 9q - 5r - 1$ 8. $-4x - y + 16z + 6$
9. $4x^2 - 9xy + 7y^2 - 10$ 10. $3x^3 - 12x^2 + 3x + 7$
11. $-2a^2 + 2ab + b^2 - 3a - 3$ 12. $-2y^3 + 3y^2 - 5y - 2$
13. (i) $12a + b - 5c$ (ii) $11a - 7b$
 (iv) $-4a - 13b + 9c$ (iv) $-11a - 12b + 11c$ 14. $3p^2 - p + 9$

EXERCISE 10.3

1. (i) $-\frac{7}{2}x^5y^2$ (ii) $-\frac{5}{2}p^4q^4r$ (iii) $-6a^5b^3$ (iv) $\frac{1}{7}x^4y^3z^2$
2. (i) $-9x^2yz + 15xy^2z - 21xyz^2$ (ii) $-4p^3q + 6p^2q^2 - 10pq^3 - 10pq$

- (iii) $\frac{70}{3}a^3b^2 - 28a^2b^3 + 10a^2b^2 + 105ab$ (iv) $-42x^8 + 24x^6 - 30x^5 + 4x^4 - 36x^3$
3. (i) $15x^2 + 14x - 8$ (ii) $acx^2 + adx + bcx + bd$
 (iii) $-12p^2 + 29p - 14$ (iv) $6x^3 - 10x^2 + 9x - 15$
 (v) $2a^2 - \frac{5}{3}a + \frac{1}{3}$ (vi) $15x^2 - 34xy + 15y^2$
4. (i) $6x^3 + 11x^2 - 1$ (ii) $x^2 - 4y^2 + 3x + 6y$
 (iii) $10x^3 - 21x^2 + 13x - 6$ (iv) $-9x^4 + 21x^3 - 10x^2 - 15x + 25$
5. (i) $6x^4 - x^3 - 19x^2 + 9x + 5$ (ii) $-15y^4 - 19y^3 + 5y^2 + 7y - 2$
 (iii) $10p^2 - 11pq - 6q^2 + 19p + 19q - 15$
6. (i) $x^3 + 9x^2 + 26x + 24$ (ii) $x^4 - 25x^2 + 144$
7. $10x^4 + 40x^3y - 27x^2y^2 + 67xy^3 + 12y^4$

EXERCISE 10.4

1. (i) $-5a$ (ii) $-\frac{3xy^2}{2z^2}$ (iii) $\frac{13r^4}{8p^2q}$ (iv) $-\frac{7b}{8a}$
2. (i) $-4x + 3y - 7z$ (ii) $3x^3 - \frac{8}{3}x^2 - 4 + \frac{1}{x}$
 (iii) $4a - 6a^2b + \frac{2}{ab} - \frac{1}{3a^2b^2}$ (iv) $-7q^2 + 16pq - \frac{15q}{2p} + \frac{11}{pq} - \frac{9}{p^2}$
3. (i) Quotient = $3x + 5$, remainder = 0 (ii) Quotient = $y^2 - y + 1$, remainder = 0
 (iii) Quotient = $4x + 3$, remainder = 10 (iv) Quotient = $3 - 2x$, remainder = 2
 (v) Quotient = $2p - 3$, remainder = 0 (vi) Quotient = $x^2 - 4x + 4$, remainder = 0
4. (i) Quotient = $2x^2 + 5x + 3$, remainder = -4
 (ii) Quotient = $y^2 - 3y + 4$, remainder = 5
 (iii) Quotient = $m^2 - 5m - 5$, remainder = 2
5. (i) Quotient = $a + 1$, remainder = 0 (ii) Quotient = $4x - 3$, remainder = -3
 (iii) Quotient = $3x^2 - 2x + 7$, remainder = $32x + 12$
6. $2x - 3y$

EXERCISE 10.5

1. (i) $-53p + 63q$ (ii) $-50x^3 + 10x^2 - x - 21$ 2. (i) $34a - 21b$ (ii) $3y$
3. (i) $19p - 2$ (ii) 0 (iii) $\frac{a^2}{2} - 6a$

CHECK YOUR PROGRESS

1. (i) polynomial, 4 (ii) not a polynomial
 (iii) polynomial; 5 (iv) not a polynomial
2. $3x^2 - x + 12$ 3. $-2x^4 + 2x^3 - 11x^2 - 7x - 6$
4. $-2x^3 + 7x^2y - 3xy^2 + 10y^3$ 5. $-4x^5 + 20x^4 - 33x^3 + 28x^2 - 14x + 3$
6. Quotient = $x - \frac{1}{2}$, remainder = 0 7. Quotient = $5x^2 - 2x - 7$, remainder = $4x - 7$
8. $(a^2 - 4ab + 4b^2)$ sq. units 9. (i) $8x - 10y$ (ii) $7x^2 + \frac{6}{5}$

EXERCISE 11.1

1. $5x - 23 = 3x + 7$ 2. $7x = 2(x + 10 + x)$ 3. $y + 4 = 3(y - 2)$
4. $A = \pi r^2$ 5. $A = \pi(R^2 - r^2)$ 6. $10x + y = 4(x + y)$

7. $d = n - 3$

8. $M = 2x + y + \frac{1}{2}z + \frac{1}{4}t$

9. $E = 26(260x + 235y)$, where E is the monthly earning in rupees.

10. $\frac{8x + 7(45 - x)}{45}$

11. $\frac{xt + ys}{t + s}$ km/hr

12. $C = 50y + 10(x - y)$

EXERCISE 11.2

1. (i) $R = \frac{100(A - P)}{PT}$ (ii) $b = \frac{A - 2a}{2}$ (iii) $x = \frac{b}{a + 2}$ (iv) $g = \frac{2(ut - s)}{t^2}$

(v) $v = \frac{2s - ut}{t}$ (vi) $n = \frac{l(m^2 - 1)}{m^2 + 1}$ (vii) $h = \frac{A - 2\pi r^2}{2\pi r}$ (viii) $r = \sqrt{\frac{V}{\pi h}}$

2. $T = \frac{100(A - P)}{PR}; 2\frac{1}{2}$ 3. $b = \frac{P - 2l}{2}; 14$ 4. $b = \frac{ac}{a - c}; 75$ 5. $g = \frac{4\pi^2 l}{T^2}; 980$

6. (i) 18

(ii) 13

(iii) 1.4

(iv) 8

7. $d = \frac{2(S - an)}{n(n - 1)}; 3$

8. $h = \frac{V}{\pi(R^2 - r^2)}; 12$

CHECK YOUR PROGRESS

1. $10(9 - x) + x - 9 = 45$

2. $n = \frac{l - a + d}{d}; 13$

3. $s = \frac{v^2 - u^2}{2a}; 43.75$

4. $x = y(y - 1); 156$

EXERCISE 12

1. (i) 72

(ii) 64

(iii) 81

(iv) $2\frac{10}{27}$

(v) $\frac{4}{5}$

(vi) 2

(vii) $6\frac{1}{5}$

(viii) 7

2. (i) 49

(ii) 32

(iii) $-\frac{1}{8}$

(iv) $15\frac{5}{8}$

(v) 81

(vi) $\frac{1}{27}$

3. (i) $\frac{8}{81}$

(ii) -48

(iii) $\frac{5}{96}$

4. (i) $2^3 \times 11$

(ii) $2^6 \times 3$

5. (i) $\frac{5^2}{7^2 \times 11^7}$ (ii) $\frac{3^4}{5^6}$

6. (i) $5x^4y^6$

(ii) $a^{-15}b^{10}$

(iii) $-\frac{8y^6}{27x^3z^6}$

(iv) $2g^5 - 2g^3 + 2g - \frac{2}{g}$

7. (i) 25

(ii) $\frac{1}{4}$

(iii) $2\frac{1}{4}$

(iv) $\frac{1}{8}$

(v) $\frac{2}{3}$

(vi) $\frac{16}{81}$

8. (i) $2x$

(ii) $9p^{-2}$

(iii) $81xy^{-3}$

(iv) $2p^2q^{-3}$

(v) $x^3y^{-2}z^4$

(vi) p^3q^{-9}

9. (i) $\frac{y^2}{x^2}$

(ii) $\frac{a^5}{b^7}$

(iii) $\frac{3^3z}{x^5y^5}$

(iv) $\frac{1}{x^{2/3}y^{1/2}}$

11. (i) x^{n+6}

(ii) $\frac{1}{25}$

(iii) 1

12. (i) 231 (ii) $5\frac{1}{3}$ (iii) $43\frac{1}{15}$
 15. (i) -1 (ii) 3 (iii) 2 (iv) -2

CHECK YOUR PROGRESS

1. (i) $5\frac{13}{27}$ (ii) 19 2. 6×7^{-21}
 3. (i) 1 (ii) $\frac{8}{9}x$ (iii) $a + b$ 6. -1

EXERCISE 13.1

1. (i) $x^2 + 8x + 15$ (ii) $y^2 - 3y - 10$
 2. (i) $a^2 + 5a - 24$ (ii) $t^2 - 17t + 66$
 3. (i) $a^2 + \frac{5}{6}a + \frac{1}{6}$ (ii) $b^2 - \frac{4}{15}b - \frac{4}{15}$
 4. (i) $x^2 - \frac{19}{7}x - \frac{6}{7}$ (ii) $x^2 - 0.3x - 0.28$
 5. (i) $40 + 3x - x^2$ (ii) $33 - 14z + z^2$
 6. (i) $4x^2 + 20x + 21$ (ii) $25y^2 + 35y - 18$
 7. (i) $49c^2 - 98c + 33$ (ii) $p^4 - 2p^2 - 15$
 8. (i) $9x^4 - 6x^2 - 35$ (ii) $21 + 4xy - x^2y^2$
 9. (i) $\frac{y^2}{9} - 3y + 14$ (ii) $10x^2 + 29xy + 10y^2$
 10. (i) $21a^2 - 29ab - 10b^2$ (ii) $12m^2n^2 - 2mn - 30$
 11. (i) $12x^4 - 7x^2y^2 - 10y^4$ (ii) $14c^4 - 25c^2d^2 + 6d^4$
 12. (i) $3a^2b^2 - abc - 10c^2$ (ii) $6x^3 + 19x^2 + 8x - 5$

EXERCISE 13.2

1. (i) $x^2 - 49$ (ii) $25x^2 - 81$
 2. (i) $y^2 - \frac{4}{9}$ (ii) $16 - 9x^2$
 3. (i) $16x^2 - 121y^2$ (ii) $\frac{4}{9}p^2 - \frac{16}{25}q^2$
 4. (i) $9 - a^2b^2$ (ii) $p^2 - \frac{1}{q^2}$
 5. (i) $\frac{4}{a^2} - \frac{25}{b^2}$ (ii) $\frac{1}{25x^2} - \frac{9}{4y^2}$
 6. (i) $9x^4 - \frac{4}{25}y^4$ (ii) $1.96a^2 - 0.09b^2$
 7. (i) $y^4 - 16$ (ii) $16p^4 - 81$
 8. (i) $x^4 - a^4$ (ii) $x^4 - y^4z^4$
 9. (i) 9936 (ii) 89964
 (iii) 99.84 (iv) 224.91

EXERCISE 13.3

1. (i) $9a^2 + 42ab + 49b^2$ (ii) $64 + 80p + 25p^2$
 2. (i) $4x^2 + \frac{12x}{y} + \frac{9}{y^2}$ (ii) $3p^2 + \frac{4}{5}\sqrt{3}pq + \frac{4}{25}q^2$

3. (i) $\frac{4x^2}{9y^2} + 2 + \frac{9y^2}{4x^2}$ (ii) $\frac{a^2}{3} + 6 + \frac{27}{a^2}$
4. (i) $4m^4 + \frac{12}{7}m^2n^2 + \frac{9}{49}n^4$ (ii) $9a^2b^2 + 3abc + \frac{c^2}{4}$
5. (i) $9a^2 - 42a + 49$ (ii) $9p^2 - 30pq + 25q^2$
6. (i) $\frac{x^2}{4} - \frac{1}{3}xy + \frac{y^2}{9}$ (ii) $\frac{4}{m^2} - \frac{12}{mn} + \frac{9}{n^2}$
7. (i) $9x^2 - 2 + \frac{1}{9x^2}$ (ii) $6c^2 - 8\sqrt{3}cd + 8d^2$
8. (i) $4a^2 + 20a + 25$ (ii) $9b^2 - 12b + 4$
 (iii) $16p^2 + \frac{16}{3}p + \frac{4}{9}$ (iv) $\frac{4}{9}z^2 - \frac{20}{21}z + \frac{25}{49}$
 (v) $9x^2 + 15xy + \frac{35}{54}y^2$ (vi) $25c^4 - 20c^2d + 4d^2$
 (vii) $6a^2 - 6a + \frac{3}{2}$ (viii) $4p^2 - 2 + \frac{1}{4p^2}$
9. (i) 251001 (ii) 1010025 (iii) 106.09
10. (i) 39601 (ii) 994009 (iii) 96.04
11. (i) $(4x + 5y)^2$ (ii) $(2p + 11)^2$
 (iii) $(3a - 7b)^2$ (iv) $\left(5m - \frac{n}{3}\right)^2$
12. (i) 14 (ii) 194
13. (i) 51 (ii) 2599
14. 29 15. 15 16. 33 17. 3
18. (i) ± 7 (ii) $\pm\sqrt{33}$ 19. (i) $\pm\sqrt{85}$ (ii) ± 7
20. (i) 23 (ii) 527 21. (i) 3 (ii) 7

EXERCISE 13.4

1. (i) $a^2 + b^2 + c^2 - 2ab + 2bc - 2ca$ (ii) $4x^2 + 9y^2 + 25z^2 + 12xy + 30yz + 20zx$
2. (i) $4p^2 + 9q^2 + 1 - 12pq - 6q + 4p$ (ii) $x^2 + \frac{1}{x^2} + 3 - \frac{2}{x} - 2x$
3. (i) $8a^3 + b^3 + 12a^2b + 6ab^2$ (ii) $343c^3 + 64d^3 + 588c^2d + 336cd^2$
4. (i) $8x^3 - 36x^2 + 54x - 27$ (ii) $a^3 - 125b^3 - 15a^2b + 75ab^2$
5. (i) $8x^3 + 12x + \frac{6}{x} + \frac{1}{x^3}$ (ii) $27a^3 - 9a + \frac{1}{a} - \frac{1}{27a^3}$
6. 29 7. 59 8. ± 11 9. 26
10. 152 11. 335 12. 52 13. 140
14. 198 15. 36 16. 243 17. 728

CHECK YOUR PROGRESS

1. (i) $10x^2 - 31xy + 24y^2$ (ii) $12p^4 + p^2q^2 - 35q^4$
 (iii) $\frac{x^2}{9} - \frac{y^2}{16}$ (iv) $\frac{4}{a^2} - \frac{9}{b^2}$
3. (i) $25a^2 + 20abc + 4b^2c^2$ (ii) $9m^2n^2 - 6mnp + p^2$
 (iii) $4x^2 + 9y^2 + z^2 - 12xy - 6yz + 4zx$ (iv) $9x^2 + 4y^2 + 1 - 12xy + 4y - 6x$
 (v) $27x^3 + 54x^2 + 36x + 8$ (vi) $8 - 36p + 54p^2 - 27p^3$

4. $\frac{1}{2x^2} - 2$
5. $x^2 + 2xy + y^2 - 1$
6. (i) 7 (ii) 47
7. (i) ± 6 (ii) ± 2
8. (i) ± 7 (ii) $\pm 3\sqrt{5}$
9. 36 10. 0
11. 76 12. (i) 7 (ii) 47 (iii) 18

EXERCISE 14.1

1. (i) $4xy^2(2y + 3x)$ (ii) $3ax^2(5x - 3)$
2. (i) $7py(3y - 8)$ (ii) $2x^2(2x - 3)$
3. (i) $2\pi r(r - 2)$ (ii) $2(9m + 8n)$
4. (i) $5abc(5c - 3ab)$ (ii) $14pq^2r(2p - 3r)$
5. (i) $2x(4x^2 - 3x + 5)$ (ii) $2(7mn + 11m - 31p)$
6. (i) $6pq(3pq - 4q + 5p)$ (ii) $3a^2b^2(9ab - 6b + 25a)$
7. (i) $5(2p - 3q)(3a - 2b)$ (ii) $3(x^2 + y^2)(a + 2b)$
8. (i) $2(x + 2y)^2(3x + 6y + 4)$ (ii) $7(a - 3b)[2(a - 3b)^2 - 3p]$
9. $5(2p + q)[2a(2p + q)^2 - 3b(2p + q) + 7]$

EXERCISE 14.2

1. (i) $(x + y)(x - 1)$ (ii) $(y - z)(y - 5)$
2. (i) $(x - y)(5y - 7)$ (ii) $(5p - 8q)(p - 2)$
3. (i) $(a - b)(ab + 3)$ (ii) $(x - 3)(x^2 + 1)$
4. (i) $(2y - 1)(3xy - 5)$ (ii) $(x - 2y)(3a + 4b)$
5. (i) $(x + y)(x + y^2)$ (ii) $(y - x)(y + x^2)$
6. (i) $(b + 1)(ab - 1)$ (ii) $(a - 2b)(2 - x)$
7. (i) $(5 + 2r)(ph - 2qk)$ (ii) $(x - a)(x - 2b)$
8. (i) $(bx - ay)(ax - by)$ (ii) $(x^2 + y^2)(a^2 + b^2)$
9. (i) $(a - 2b)(a^2 + b)$ (ii) $3(x - 1)(xy + 4)$
10. (i) $(a + b)(ab - bc + xy)$ (ii) $(a - b)(x^2 + y^2 + z^2)$
11. (i) $(x - 1)(2 - x + a)$ (ii) $(ax + by)(1 + a - ax - by)$

EXERCISE 14.3

1. (i) $(2p + 3)(2p - 3)$ (ii) $(2x + 13y)(2x - 13y)$
2. (i) $(3xy + 5)(3xy - 5)$ (ii) $\left(4x + \frac{1}{12}\right)\left(4x - \frac{1}{12}\right)$
3. (i) $5(2x + 3y)(2x - 3y)$ (ii) $\left(\frac{3}{4} + 5ab\right)\left(\frac{3}{4} - 5ab\right)$
4. (i) $(2a + 3b + 4c)(2a + 3b - 4c)$ (ii) $(1 + b - c)(1 - b + c)$
5. (i) $(4x + 3y)(2x + 3y)$ (ii) $5(m + n)(n - m)$
6. (i) $(9a + b)(a + 9b)$ (ii) $(13x + 4)(5x + 8)$
7. (i) $x(x + 5)(x - 5)$ (ii) $7(3pq + 1)(3pq - 1)$
8. (i) $8b(2a + 3b)(2a - 3b)$ (ii) $(a + b)(3a + 3b + 5)(3a + 3b - 5)$
9. (i) $(x + y + 1)(x - y - 1)$ (ii) $(a - b + c)(a - b - c)$
10. (i) $(3x + y - 2)(3x - y + 2)$ (ii) $(2a + 2b + 1)(2a - 2b + 1)$
11. (i) $(25 + p^2)(5 + p)(5 - p)$ (ii) $5y(y^2 + 9)(y + 3)(y - 3)$
12. (i) 984000 (ii) 356000 (iii) 72 (iv) 21
13. $a(b + c)(b - c)$

EXERCISE 14.4

1. (i) $(x + 1)(x + 2)$ (ii) $(z + 4)(z + 6)$
2. (i) $(x + 7)(x + 8)$ (ii) $(p + 5)(p + 17)$

3. (i) $(x - 4)(x - 6)$
 4. (i) $(x + 6)(x - 9)$
 5. (i) $(y + 3)(y - 8)$
 6. (i) $(3x + 2)(x + 4)$
 7. (i) $(7x - 8)(2x - 1)$
 8. (i) $(x + 2)(5x - 3)$
 9. (i) $(2x + 5)(3x - 2)$
 10. (i) $(1 - 21y)(1 + 3y)$
 11. (i) $(x + 5y)(x - 8y)$
 12. (i) $(ab + 5)(2ab - 9)$
 13. (i) $(a + b + 3)(a + b - 14)$
 14. (i) $(x - 2y - 5)(x - 2y - 1)$
- (ii) $(m - 2)(m - 21)$
 (ii) $(a + 3)(a - 10)$
 (ii) $(t + 27)(t - 4)$
 (ii) $(3y + 4)(y + 2)$
 (ii) $(4x - 7)(3x + 5)$
 (ii) $(x - 3)(2x + 3)$
 (ii) $(1 - 2x)(5 + 6x)$
 (ii) $(3x + 4y)(x - 3y)$
 (ii) $(2pq - 3)(5pq - 3)$
 (ii) $(4x + 5)(3x - 2)$
 (ii) $(4 + 5p + 5q)(2 - p - q)$
 (ii) $(1 + 4x - 6y)(7 - 8x + 12y)$

CHECK YOUR PROGRESS

1. (i) $3x^2y(7y^2 - 4x)$
 2. (i) $5(2x - 3)[3(2x - 3)^2 - 2]$
 3. (i) $(x + 1)(2a^2 - b)$
 4. (i) $(x - z)(xz + y^2)$
 5. (i) $(c - d)(bc - bd - a + 3)$
 6. (i) $3p(2p + 1)(2p - 1)$
 7. (i) $(a - y)(x + b)(x - b)$
 8. (i) $(x + 8)(x - 6)$
 9. (i) $(x - 2)(3x + 2)$
 10. (i) $(x + 11y)(x - 9y)$
 11. (i) $(3a - 3b + 11)(a - b - 4)$
 12. (i) 800000
- (ii) $6pq(4q - 3p - 10)$
 (ii) $(b - c)[a(b + c) + d]$
 (ii) $(p - a)(p - 2b)$
 (ii) $5a(a - 1)(a^2 + 6)$
 (ii) $(p + 4q)(p - 4q)$
 (ii) $(5x + 2y)(x - 2y)$
 (ii) $(3x + y - 4)(3x - y + 4)$
 (ii) $(p - 15)(p + 8)$
 (ii) $(3ab - 4)(5ab - 2)$
 (ii) $\pi a(a^2 + \pi b)(a^2 - \pi b)$
 (ii) $(a + 3)(a - 3)(a + 1)(a - 1)$
 (ii) 24

EXERCISE 15.1

1. (i) $2xy; 12x^2y^2$
 2. (i) $4xy^2; 84x^3y^3z^2$
 3. (i) $mn; 30m^3n^3$
 4. (i) $3pq^2r; 36p^3q^3r^3$
 5. (i) $x + 3y; x(x + 3y)(x - 3y)$
 6. (i) $2a - 5; (2a + 5)(2a - 5)^2$
 7. (i) $x + 3; (x + 3)^2(2x + 1)$
 8. (i) $x + 2; 6x(x + 2)^2(x + 3)$
- (ii) $6a^2b^2; 36a^3b^5$
 (ii) $8abc; 336a^2b^2c^2d$
 (ii) $3ab^2; 60a^4b^4$
 (ii) $5y; 60x^3y^3z^5$
 (ii) $3x - 4y; 5x(3x + 4y)(3x - 4y)$
 (ii) $2(x + 2y); 12x(x + 2y)(x - 2y)$
 (ii) $2a + 1; (2a + 1)^2(3a + 2)$
 (ii) $x - 3; 4(x - 3)^2(x + 3)(2x + 7)$

EXERCISE 15.2

1. (i) $-\frac{2}{3a}$
 3. (i) $\frac{1}{2-3x}$
 5. (i) $\frac{3y}{x-2y}$
 7. (i) 3
- (ii) $\frac{2p^2}{5qr}$
 (ii) $\frac{x-1}{x^2}$
 (ii) $\frac{3(x-2)}{x-5}$
 (ii) $\frac{x(x+1)}{2(x-2)}$
2. (i) $\frac{1}{x(x+2)}$
 4. (i) $\frac{x+1}{x+3}$
 6. (i) $\frac{x-y}{x+y}$
 8. (i) $\frac{3}{m-3}$
- (ii) $\frac{x-4}{x}$
 (ii) $\frac{xy}{x+y}$
 (ii) $\frac{2x+1}{3x+1}$
 (ii) $\frac{x(3x+4y)}{x+5}$

9. (i) $\frac{13m+10}{15}$

(ii) $\frac{5x}{2(5x-1)}$

10. (i) $\frac{5t+7}{(t+1)(t+2)}$

(ii) $-\frac{2}{m^2-4}$

11. (i) $\frac{2}{x+y}$

(ii) $-\frac{2}{(x-1)(x-2)(x-3)}$

CHECK YOUR PROGRESS

1. $6xyz^2; 360x^3y^4z^4$

2. $2(x-2y); 12x(x-2y)^2(x+2y)(x+3y)$

3. (i) $\frac{2ab(a-b)}{a+b}$

(ii) $\frac{3x-y}{4x-y}$

4. (i) $\frac{a}{b}$

(ii) $\frac{(x+1)(x+3)}{x^2(x-3)}$

5. (i) $\frac{x+1}{p+1}$

(ii) $\frac{x-1}{x+1}$

6. (i) $\frac{x+7y}{(x-y)(x+y)}$

(ii) $\frac{5x-1}{(x+1)(2x-1)(3x-1)}$

EXERCISE 16.1

1. (i) 3

(ii) $\frac{11}{3}$

2. (i) $\frac{10}{9}$

(ii) 4

3. (i) 22

(ii) $6\frac{1}{2}$

4. (i) $\frac{3}{5}$

(ii) 60

5. (i) -2

(ii) -3.7

6. (i) 16

(ii) 17

7. (i) -10

(ii) -2

8. (i) -1

(ii) $\frac{1}{5}$

9. (i) $2\frac{1}{4}$

(ii) $3\frac{1}{2}$

10. $78\frac{1}{2}$

11. $x = 6, p = \frac{5}{6}$

12. $x = -\frac{7}{5}; y = \frac{7}{9}$

EXERCISE 16.2

1. -7

2. 3

3. 10, 11; 12, 13

4. -2, 0, 2

5. 4, 5, 6

6. 25, 27

7. $\frac{7}{15}$

8. 10, 25

9. 3

10. 62

11. 27

12. ₹ 36, ₹ 30

13. 27

14. 8 years, 2 years

15. 28 years, 4 years

16. 15 years, 9 years

17. 32, 25

18. 75, 125, 175

19. 28

20. 12

21. $65^\circ, 115^\circ$

22. $50^\circ, 60^\circ, 70^\circ$

23. 3; 22 units

24. 30 cm

25. 322 cm^2

26. $2[(x+10) + (x+8)] = 2 \times 2(10+8); 323 \text{ cm}^2$

27. 25 km/hr, 30 km/hr

28. 60 km/hr, 90 km/hr

29. 0.6 km

30. 25 km/hr

EXERCISE 16.3

1. (i) $\{-1, 0, 1, 3\}$

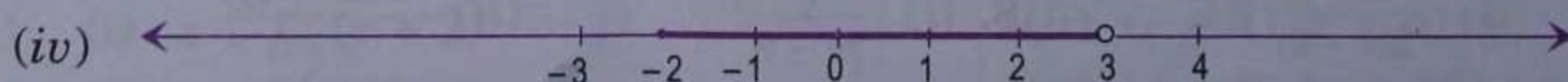
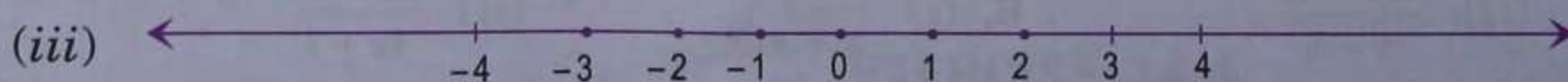
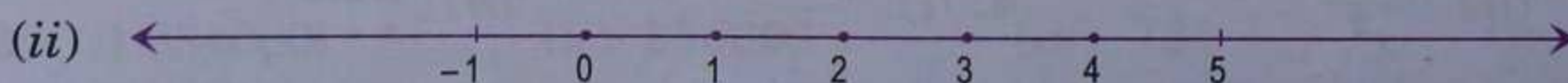
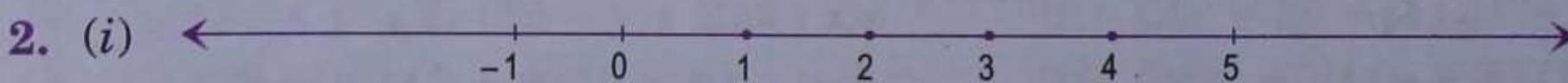
(ii) $\{-7, -5, -3\}$

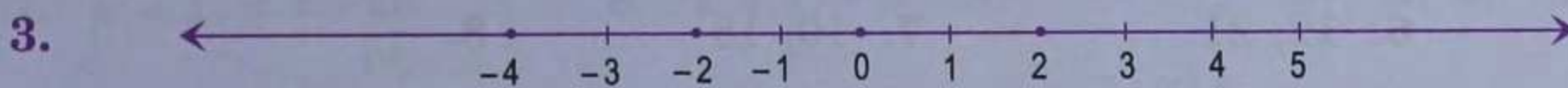
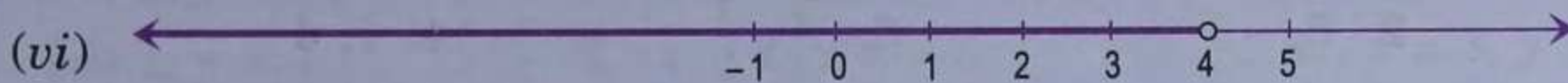
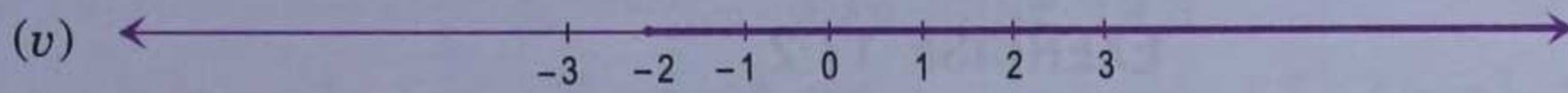
(iii) $\{3\}$

(iv) $\{-3, -1, 0, 1, 3\}$

(v) $\{-7, -5, -3, -1, 0\}$

(vi) $\{0, 1, 3\}$





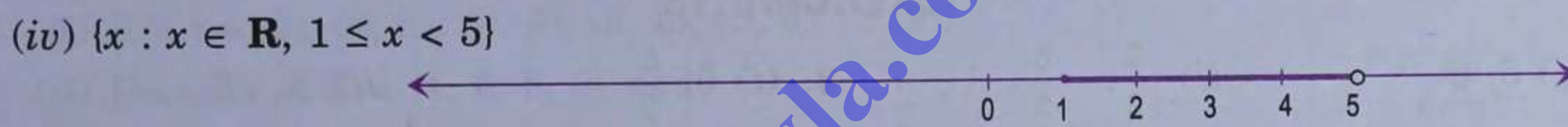
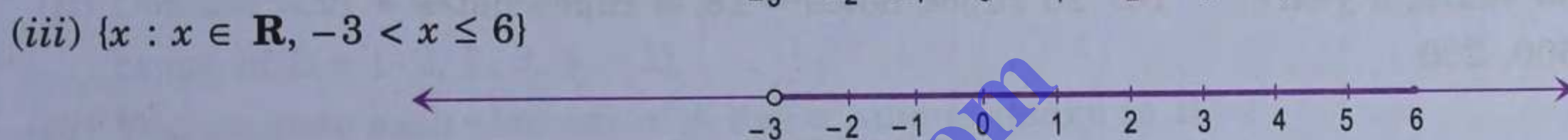
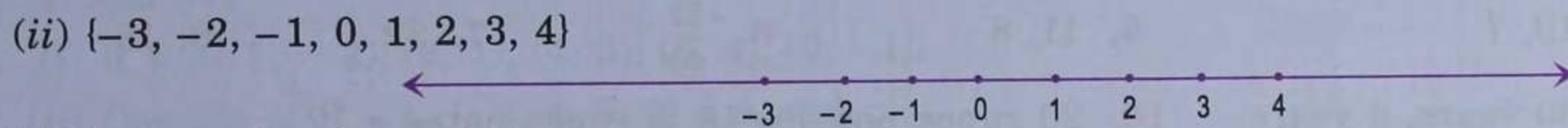
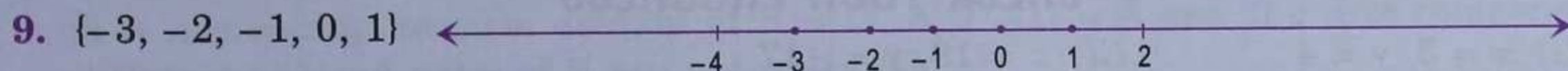
4. (i) {1, 2, 3} (ii) {-1, 0, 1, 2} (iii) {-5} (iv) ϕ

5. (i) {6, 9, 12} (ii) {-6, -3} (iii) {-6, -3, 0}

6. (i) {1, 2, 3} (ii) {0, 1, 2, 3, 4} (iii) {1, 2, 3, 4} (iv) {-1, 0, 1, 2, ...}

7. (i) {1, 2, 3, 4, 5} (ii) {0, 1, 2} (iii) {0, 1, 2, 3, 4, 5} (iv) {..., -8, -7, -6}

8. (i) {1, 2, 3, 4} (ii) {0, 1} (iii) {0, 1, 2, 3} (iv) {1, 2, 3, 4}



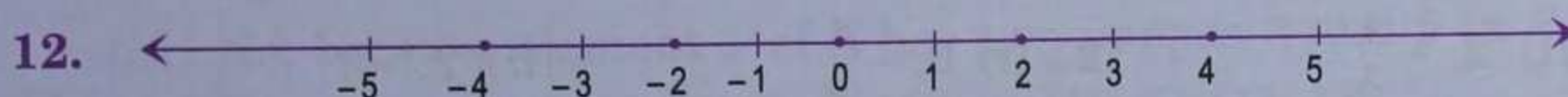
CHECK YOUR PROGRESS

1. (i) -1 (ii) -3 (iii) $\frac{3}{2}$ (iv) 1

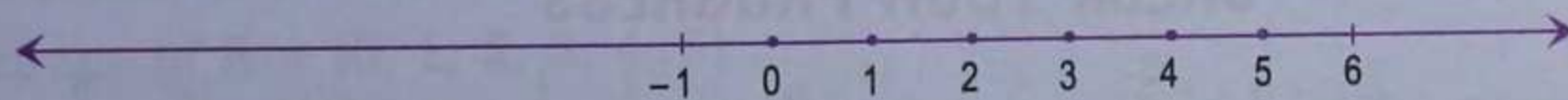
2. 22, 24 3. 2 4. 17 5. 72

6. Ankita 12 years, Anu 14 years

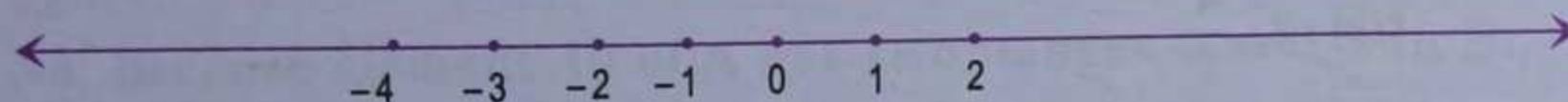
7. 5 years 8. 19 9. 17 10. 240 11. 195 km



13. (i) {0, 1, 2, 3, 4, 5}



(ii) {-4, -3, -2, -1, 0, 1, 2}



EXERCISE 17.1

- | | | | |
|--------------------------|-----------------------|---|-----------------------|
| 1. (i) $x = 5, y = 4$ | (ii) $x = 6, y = -2$ | 2. (i) $x = 1, y = 4$ | (ii) $x = 1, y = -5$ |
| 3. (i) $x = -8, y = -4$ | (ii) $x = 1, y = 2$ | 4. (i) $x = 2, y = 1$ | (ii) $x = 7, y = -2$ |
| 5. (i) $x = 4, y = -1$ | (ii) $x = 7, y = 2$ | 6. (i) $x = 11, y = 14$ | (ii) $x = 8, y = 9$ |
| 7. (i) $p = 20, q = -12$ | (ii) $a = 4, b = 3$ | 8. (i) $x = 2, y = 5$ | (ii) $x = -3, y = 9$ |
| 9. (i) $x = 10, y = 6$ | (ii) $x = 3, y = 2$ | 10. (i) $x = 2, y = 1$ | (ii) $x = -1, y = -2$ |
| 11. (i) $x = 1, y = -1$ | (ii) $x = -2, y = -3$ | 12. (i) $x = \frac{1}{3}, y = -\frac{1}{2}$ | (ii) $x = 2, y = 5$ |

EXERCISE 17.2

1. 24, 16 2. 5, -3 3. $\frac{3}{2}, \frac{1}{2}$ 4. 7, 4
5. 22, 13 6. 12, 21 7. 10, 15 8. $\frac{17}{30}$
9. 48 10. 25 11. Eraser ₹ 3, pen ₹ 4
12. ₹ 206 13. ₹ 3 14. 8
15. Sumitra 52 years, daughter 12 years. 16. Sujata 26 years, Sushma 21 years.
17. ₹ 6000, ₹ 8000 18. $x = 3\frac{1}{2}, y = 1\frac{1}{2}$ 19. (i) 10 km/hr (ii) 4 km/hr

CHECK YOUR PROGRESS

1. (i) $x = 3, y = 4$ (ii) $x = 19, y = -17$
2. (i) $x = -\frac{7}{8}, y = -\frac{1}{4}$ (ii) $x = 12, y = 2$
3. (i) $x = 6, y = -4$ (ii) $x = -3, y = 4$
4. 10, 7 5. 11, 8 6. $\frac{12}{60}$ 7. 32 8. 15
9. 30 years, 6 years 10. 20 rupee notes = 16, 5 rupee notes = 12
11. 500, 200

EXERCISE 18

1. (i) 5, 6 (ii) $\frac{5}{2}, -\frac{5}{2}$ 2. (i) $0, \frac{5}{2}$ (ii) 8, -6
3. (i) 3, -2 (ii) $1, \frac{1}{2}$ 4. (i) $2, -\frac{4}{3}$ (ii) $\frac{5}{2}, \frac{3}{2}$
5. (i) $\frac{5}{2}, -5$ (ii) 7, -7 6. (i) $\frac{9}{2}, -2$ (ii) $0, -\frac{11}{6}$
7. (i) $-\frac{1}{2}, -\frac{1}{2}$ (ii) -8, 16 8. (i) $\frac{2}{3}, -\frac{2}{7}$ (ii) -1, $\frac{3}{2}$
9. (i) -5, $\frac{1}{6}$ (ii) $2, \frac{1}{2}$ 10. (i) $2, -\frac{4}{3}$ (ii) 3, 9
11. (i) 4, 3 (ii) $2, -\frac{4}{3}$ 12. (i) $5, -\frac{1}{2}$ (ii) 2, -3

CHECK YOUR PROGRESS

1. (i) -3, $\frac{1}{2}$ (ii) $2, -\frac{2}{3}$ 2. (i) $\frac{1}{4}, \frac{1}{4}$ (ii) -2, $-\frac{3}{2}$
3. (i) $5, \frac{5}{2}$ (ii) $3, \frac{4}{3}$

EXERCISE 19.1

1. (i) True (ii) False (iii) True (iv) False
(v) False (vi) True (vii) False (viii) False
3. Rectangle; 15 square units
4. Isosceles triangle; 10 square units
5. (0, 0), (6, 0), (6, 4), (0, 4)

EXERCISE 19.3

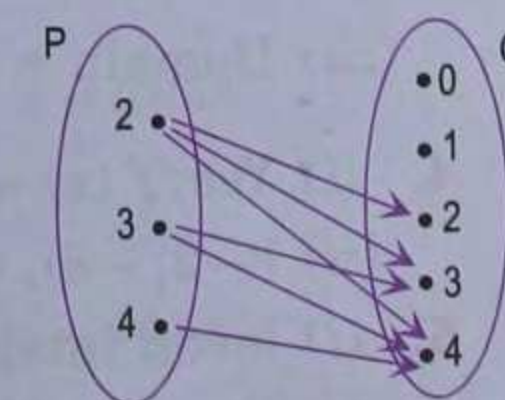
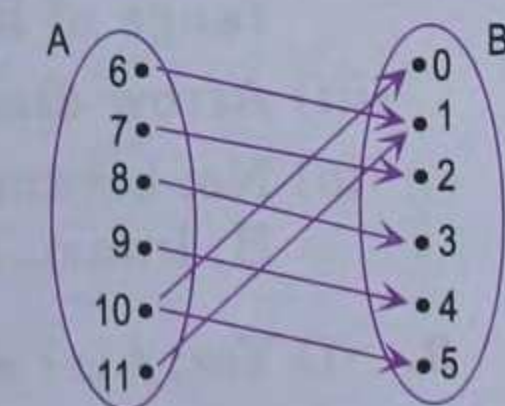
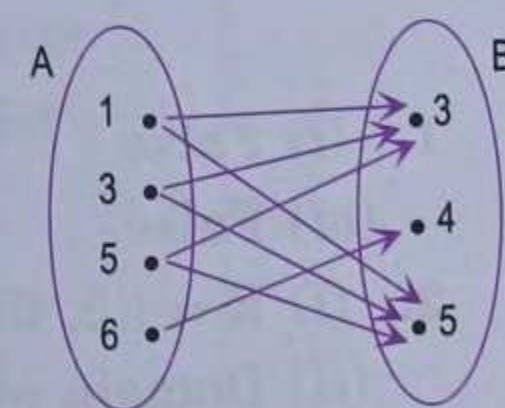
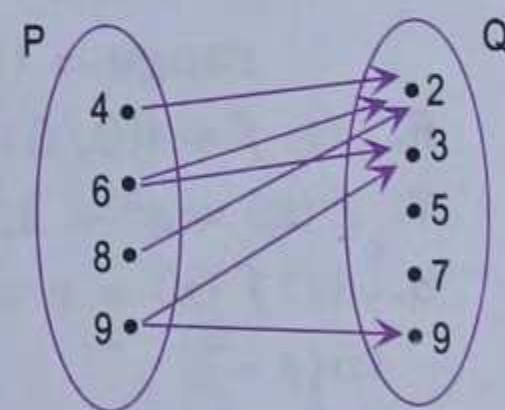
1. $x = 2, y = -2$
2. $x = 2, y = 1$
3. $x = -1, y = -1$
4. $x = 1, y = 1$
5. $x = 2, y = -1$
6. $x = 3, y = 4$
7. $x = 1, y = -1$
8. $x = 1, y = -3$
9. 28 sq. units

CHECK YOUR PROGRESS

1. Parallelogram; 24 sq. units
2. $(2, -2)$; 25 sq. units
4. The two lines are parallel.
5. (i) $x = 5, y = 2$
- (ii) $x = 4, y = 5$

EXERCISE 20.1

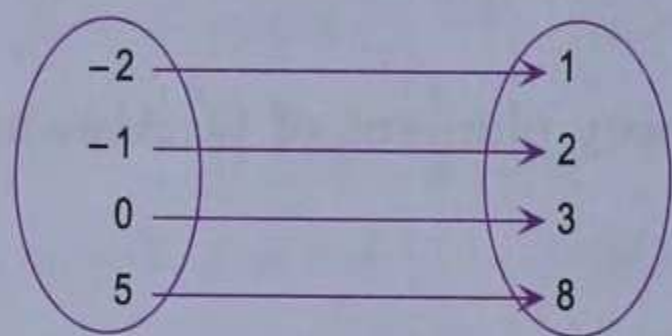
1. R is a mapping because domain of $R = \{3, 5, 7 - 1\} = A$ and the first components of different ordered pairs of R are not repeated.
2. No; because the element 10 of P is not associated to any element of Q. Also note that the element 4 of P has two images 5 and 7 in Q.
3. (i) and (iv)
4. (i) $R = \{(-1, -2), (2, 1), (4, 3), (5, 4), (0, -1)\}$
 (ii) Domain of $R = \{-1, 2, 4, 5, 0\} = A$ and
 range of $R = \{-2, 1, 3, 4, -1\}$
 (iii) Yes; because each element of A has a unique image in B.
5. (i) $R = \{(4, 2), (6, 2), (6, 3), (8, 2), (9, 3), (9, 9)\}$
 (ii) Domain of $R = \{4, 6, 8, 9\}$ and
 range of $R = \{2, 3, 9\}$
 (iii) R can be represented by an arrow diagram shown in the adjoining figure.
 (iv) No; because element 6 of P has been associated to two elements 2 and 3 of Q.
6. (i) $R = \{(1, 3), (1, 5), (3, 3), (3, 5), (5, 3), (5, 5), (6, 4)\}$
 (ii) R can be represented by an arrow diagram shown in the adjoining figure.
 (iii) No; because element 1 of A has two images 3 and 5 in B.
7. (i) $R = \{(6, 1), (7, 2), (8, 3), (9, 4), (10, 0), (10, 5), (11, 1)\}$
 (ii) Domain of $R = \{6, 7, 8, 9, 10, 11\} = A$ and
 range of $R = \{0, 1, 2, 3, 4, 5\}$
 (iii) R can be represented by an arrow diagram shown in the above figure.
 (iv) No; because element 10 of A has two images 0 and 5 in B.
8. (i) $R = \{(2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)\}$
 (ii) Domain of $R = \{2, 3, 4\}$ and
 range of $R = \{2, 3, 4\}$
 (iii) R can be represented by an arrow diagram shown in the adjoining figure.
 (iv) No; because element 2 of P has three images 2, 3 and 4 in Q.



EXERCISE 20.2

1. (i) $\{(a, e), (b, e), (c, i)\}$. Not a function as d has no image.
 (ii) $\{(a, e), (b, e), (c, i), (c, k), (d, k)\}$. Not a function as c does not have a unique image.
 (iii) $\{(a, e), (b, e), (c, i), (d, k)\}$. It is a function.
 (iv) $\{(-2, 4), (2, 4), (-3, 9), (3, 9)\}$. It is a function.
2. (i) $\{(-3, 9), (-1, 1), (0, 0), (4, 16), (7, 49)\}$
 (ii) Yes; $f(x) = x^2$ (iii) $\{-3, -1, 0, 4, 7\}$ (iv) $\{9, 1, 0, 16, 49\}$
3. (i) $\left\{\left(2, \frac{1}{2}\right), (1, 1), \left(3, \frac{1}{3}\right), \left(4, \frac{1}{4}\right)\right\}$ (ii) Yes; $f(x) = \frac{1}{x}$
 (iii) $\{2, 1, 3, 4\}$ (iv) $\left\{\frac{1}{2}, 1, \frac{1}{3}, \frac{1}{4}\right\}$

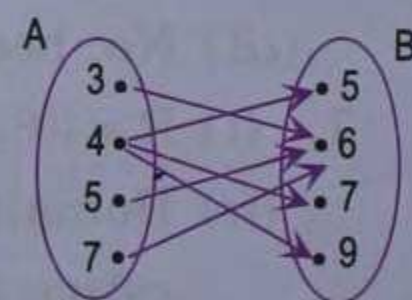
4. (i) Arrow diagram is



- (ii) Yes; each image is 3 more than pre-image;
 $f(x) = x + 3$
- (iii) Domain = $\{-2, -1, 0, 5\}$, range = $\{1, 2, 3, 8\}$
5. (i) Yes; $g(x) = 10x$
 (ii) Domain = $\{1, 2, 3, 4, \dots\} = \mathbf{N}$,
 range = $\{10, 20, 30, 40, \dots\}$
6. (i) $f = \{(0, 5), (2, 9), (4, 13), (6, 17)\}$ (ii) $\{5, 9, 13, 17\}$
7. $f(x) = x^2 + 2$; (i) 123 (ii) 11 (iii) 2 (iv) 11 (v) 123
8. (i) $f(x) = x + 3$ (ii) $f(-2) = 1, f(0) = 3, f(2) = 5$
 (iii) -1 (iv) 1

CHECK YOUR PROGRESS

1. (i) False (ii) False (iii) False (iv) True (v) True
 (vi) False (vii) True (viii) True (ix) True (x) True
2. (i) $R = \{(3, 6), (4, 5), (4, 7), (4, 9), (5, 6), (7, 6)\}$
 (ii) Domain of $R = \{3, 4, 5, 7\} = A$ and
 range of $R = \{5, 6, 7, 9\} = B$
 (iii) Arrow diagram is shown in the adjoining figure.
 (iv) No; because the element 4 of A does not have a unique image in B . Infact, element 4 of A has three images 5, 7 and 9 in B .
3. (i) Yes; $f(x) = x + \frac{1}{x}$; $f(5) = 5\frac{1}{5}$ (ii) 6
 (iii) Domain = $\{1, 2, \dots, 10\}$ (iv) Range = $\left\{2, 2\frac{1}{2}, 3\frac{1}{3}, \dots, 10\frac{1}{10}\right\}$
4. (i) Yes; $f(x) = x^3$
 (ii) $\{(-2, -8), (-1, -1), (0, 0), (1, 1), (2, 8)\}$
5. (i) $\{\text{even integers}\}$ (ii) 6 (iii) 54
6. (i) Yes; $\{(a, 1), (b, 2), \dots, (y, 25), (z, 26)\}$ (ii) 8 (iii) 'x'



EXERCISE 21.1

1. $35^\circ, 55^\circ$ 2. 50° 3. $30^\circ, 105^\circ$ 4. $50^\circ, 130^\circ$
 5. $x = 115^\circ, y = 65^\circ$ 6. (i) 59° (ii) 75° (iii) 36°
 7. $x = 45^\circ, y = 75^\circ, z = 90^\circ, p = 150^\circ$ 8. $75^\circ, 105^\circ$
 9. (i) 70° (ii) 110° 10. 32 (i) 40° (ii) 140° (iii) 103°
 11. $x = 35^\circ, y = 45^\circ, z = 100^\circ$ 13. (i) Yes (ii) No

EXERCISE 21.2

1. (i) $x = 65^\circ, y = 115^\circ, z = 115^\circ, p = 115^\circ$ (ii) $a = 62^\circ, c = 48^\circ, b = 70^\circ$
 (iii) $x = 44^\circ, y = 24^\circ, z = 112^\circ$
 2. (i) $x = 35^\circ, y = 135^\circ$ (ii) $x = 36^\circ, y = 108^\circ$ (iii) $x = 25^\circ, y = 45^\circ$
 3. $x = 62^\circ, y = 78^\circ, z = 102^\circ$
 4. (i) $a = 72^\circ, b = 72^\circ, c = 108^\circ, d = 72^\circ$
 (ii) $a = 112^\circ, b = 48^\circ, c = 20^\circ, d = 48^\circ$
 (iii) $a = 85^\circ, b = 62^\circ, c = 118^\circ, d = 118^\circ$
 5. (i) $a = 136^\circ, b = 46^\circ, c = 44^\circ$
 (ii) $a = 72^\circ, b = 108^\circ, c = 115^\circ$
 (iii) $x = 30^\circ$
 6. (i) $a = 70^\circ, b = 110^\circ, c = 68^\circ, d = 70^\circ, e = 112^\circ$
 (ii) $a = 110^\circ, b = 70^\circ, c = 38^\circ, d = 142^\circ$
 7. (i) $x = 60^\circ, y = 60^\circ, z = 70^\circ, t = 110^\circ$
 (ii) $x = 57^\circ$
 8. (i) Yes (ii) Yes (iii) No
 9. 28°

CHECK YOUR PROGRESS

1. $25^\circ, 65^\circ$ 2. 50° 3. 35° (i) 125° (ii) 109°
 4. (i) $x = 50^\circ, y = 50^\circ, z = 130^\circ$ (ii) 72° (iii) 120° (iv) 50°
 5. (i) $x = 42^\circ, y = 63^\circ, z = 75^\circ, p = 138^\circ$ (ii) $x = 75^\circ, y = 15^\circ$
 (iii) $x = 145^\circ, y = 55^\circ, z = 125^\circ$
 6. (i) 38 (ii) 23 7. $\angle x = 39^\circ, \angle y = 96^\circ, \angle z = 39^\circ$
 8. 37° 9. 50°

EXERCISE 22.1

1. (i) equal (ii) equal (iii) $45^\circ, 45^\circ, 90^\circ$ (iv) 60
 2. (i) 40° (ii) 40° (iii) 70°
 3. (i) $x = 49^\circ, y = 41^\circ$ (ii) $x = 56^\circ, y = 34^\circ, z = 124^\circ$ (iii) $x = 108^\circ$
 4. (i) $x = 35^\circ, y = 115^\circ$ (ii) $x = 50^\circ, y = 68^\circ$ (iii) $x = 36^\circ$
 5. (i) $x = 50^\circ, y = 40^\circ, z = 130^\circ,$ (ii) $x = 55^\circ, y = 75^\circ, z = 105^\circ$
 6. (i) $x = 35^\circ, y = 97^\circ$ (ii) $x = 52^\circ$ (iii) $x = 110^\circ$
 7. (i) $x = 51^\circ, y = 39^\circ$ (ii) $x = 64^\circ, y = 52^\circ$ (iii) $x = 98^\circ, y = 77^\circ$
 8. (i) $x = 55^\circ, y = 125^\circ, z = 105^\circ$ (ii) $x = 32^\circ, y = 64^\circ, z = 52^\circ$ (iii) $x = 108^\circ$
 9. (i) 35° (ii) 75° 10. $54^\circ, 60^\circ, 66^\circ$ 11. $66^\circ, 24^\circ$ 13. 44
 14. $80^\circ, 80^\circ, 20^\circ$ 15. $55^\circ, 55^\circ, 70^\circ$ 16. $72^\circ, 54^\circ, 54^\circ$
 17. (i) 34 (ii) 70 (iii) 44°

EXERCISE 22.2

1. (i) BC (ii) AB 2. (i) PQ (ii) QR; QR, PR, PQ
 3. (i) $\angle A$ (ii) $\angle B$; $\angle A$, $\angle C$, $\angle B$
 4. AB 5. PR 6. (i) AB (ii) BC
 7. (i) $\angle C$ (ii) $\angle A$ 8. AB, AC, BC 9. AC, DC, AD
 10. Greatest side is BC and smallest side is AC

EXERCISE 22.3

1. (i) congruent; S.S.S. (ii) congruent; A.A.S.
 (iii) congruent; R.H.S. (iv) congruent; A.S.A.
 (v) not congruent; included angles are not equal
 (vi) not congruent; corresponding sides are not equal
 2. (i) congruent; S.A.S.
 (ii) not necessary; included angle may not be equal
 (iii) congruent; A.A.S. (iv) congruent; R.H.S.
 (v) congruent; S.S.S.
 9. (i) $x = 15^\circ$, $y = 43^\circ$ (ii) $x = 60$, $y = 5$ units
 (iii) $x = 5$ units, $y = 16$ units.

EXERCISE 22.4

1. (i) 17 cm (ii) 24 cm (iii) 40 cm (iv) 20 cm (v) 2 cm (vi) 7 cm
 2. (i) Yes (ii) No (iii) Yes 3. 12 m 4. (i) 25 m (ii) 24 m
 5. (a) 24 cm (b) 17 cm 6. 15 m
 7. (i) 24 cm (ii) 10 cm; 90° 8. 24 cm
 9. (i) 17 cm (ii) 68 cm

CHECK YOUR PROGRESS

1. (i) 66° (ii) 20°
 2. (i) $x = 46^\circ$, $y = 26^\circ$, $z = 72^\circ$ (ii) $x = 65^\circ$, $y = 67^\circ$, $z = 92^\circ$
 3. (i) $x = 12$, $y = 70$ (ii) $x = 60$, $y = 45$
 4. $22\frac{1}{2}^\circ$, $22\frac{1}{2}^\circ$, 135° 6. 110° 7. $\angle P$
 8. $CA < 14$ cm and $CA > 2$ cm 9. BD, DC, AB.
 13. (a) 13 cm (b) 9 cm
 14. (i) 3 cm (ii) 4 cm; 90° 15. 16 cm

EXERCISE 23.1

1. 95° 2. 67° 3. 73° 4. 75° 5. 50°
 6. (i) 100 (ii) 100° , 80° , 70° , 110°
 7. 48° , 72° , 96° , 144° 8. 60° , 100° , 120° 9. 75° , 120°
 10. $\angle A = 72^\circ$, $\angle D = 108^\circ$, $\angle B = 84^\circ$, $\angle C = 96^\circ$
 11. (i) 24 (ii) 76° (iii) 54°

EXERCISE 23.2

1. (i) False (ii) True (iii) True (iv) True (v) False
 (vi) True (vii) False (viii) True (ix) False
2. $\angle A = 55^\circ$, $\angle B = 125^\circ$ 3. 19 cm 4. 75° , 105° , 75° , 105°
5. $x = 43^\circ$, $y = 137^\circ$ 6. $\angle A = 75^\circ$, $\angle B = 86^\circ$, $\angle C = 94^\circ$, $\angle D = 105^\circ$
7. (i) 54° (ii) 126° 8. (i) 31° (ii) 59° (iii) 59°
9. (i) 40° (ii) 80° (iii) 100°
10. (i) 66° (ii) 38° (iii) 76° 14. $\angle A = \angle B = 78^\circ$, $\angle D = 102^\circ$
15. (i) 17° (ii) 73° (iii) 45° (iv) 73°

EXERCISE 23.3

1. (i) 720° (ii) 1080° (iii) 1440° 2. (i) 1620° (ii) 3060° (iii) 4140°
3. (i) 120° (ii) $\left(128\frac{4}{7}\right)^\circ$ (iii) 135° (iv) 144° (v) 160° (vi) 165°
4. (i) 5 (ii) 8 (iii) 15 (iv) 7
5. (i) 20 (ii) 5 (iii) 6 (iv) 9 (v) 11
6. (i) 9 (ii) 13 (iii) 21 7. (i) Yes (ii) No (iii) No (iv) No
8. (i) No (ii) Yes (iii) Yes
9. 92 10. 156° , 132° , 108° , 84° , 60° 11. 140° 12. 135°
13. (i) 30° (ii) 150° (iii) 12 14. 6 15. 165°
16. (i) 108° (ii) 36° (iii) 72°

CHECK YOUR PROGRESS

1. 29° 2. 108° , 118° 3. (i) 106° (ii) 80° (iii) 100°
4. 54° , 72° , 108° and 126° ; no 5. 72° , 108° , 72° , 108°
6. $x = 40^\circ$, $y = 35^\circ$ 7. 31 : 35
8. (i) 36° (ii) 24° (iii) 96°
9. $x = 42^\circ$, $y = 96^\circ$, $z = 64^\circ$ 12. 171° 13. 16
14. 23 15. 4 16. 5 17. 6 18. 50 19. 10
20. (i) 135° (ii) $22^\circ 30'$ (iii) $112^\circ 30'$

EXERCISE 24.2

2. Equilateral triangle 3. Isosceles triangle
4. 90° ; right angled triangle
5. $\angle P = 60^\circ$, $\angle R = 60^\circ$; equilateral triangle 6. $\angle A = \angle C = 52\frac{1}{2}^\circ$
7. 5 cm 8. 45°
14. Each angle = 60° 16. 90°

EXERCISE 25

1. (i) 37 cm^2 (ii) 18.5 cm^2
2. (i) 42 sq. units (ii) 42 sq. units 3. 19 sq. units
4. (i) 35.2 cm^2 (ii) 17.6 cm^2
5. (i) 24 cm^2 (ii) 12 cm^2

CHECK YOUR PROGRESS

2. 5 cm 3. 6 units

EXERCISE 26

1. (i) diameter (ii) the centre, the circle (iii) on the circle
 (iv) passes through (v) equal (vi) 90°
2. (i) False (ii) True (iii) True (iv) True
 (v) True (vi) True (vii) False (viii) True
3. 2.5 cm 6. 4 cm 7. 12 cm
8. (i) $x = 58^\circ, y = 40^\circ$ (ii) $x = 37^\circ, y = 53^\circ$ (iii) 45° (iv) 32°
 (v) $x = 50^\circ, y = 130^\circ$ (vi) $x = 45^\circ, y = 22\frac{1}{2}^\circ$ (vii) 25°
 (viii) $x = 45^\circ, y = 45^\circ$ (ix) $x = 54^\circ, y = 27^\circ$
9. (i) $x = 17, y = 8.5$ (ii) $x = 13, y = 12$ (iii) $x = 30, y = 18$

CHECK YOUR PROGRESS

3. 90° 4. 4 cm 6. (i) 55° (ii) 25°

EXERCISE 27.1

1. (i) One (ii) none (iii) one
 (iv) one (v) one (vi) none
 (vii) four (viii) three (ix) four
2. (i) None (ii) none (iii) none
 (iv) none (v) none (vi) two
 (vii) four (viii) three (ix) four
3. (i) False (ii) False (iii) True
 (iv) False (v) False (vi) False

EXERCISE 27.2

1. (i) (3, -5) (ii) (-3, -4) (iii) (-2, 6) (iv) (0, -3) (v) (-3, 0)
2. (i) (2, 5) (ii) (-3, -4) (iii) (2, -6) (iv) (3, 0) (v) (0, -2)
3. $A'(-3, -4), B'(2, -5)$; Yes 4. $P'(-2, -5), Q'(-3, 7)$; Yes
5. $A'(-2, -3), B'(-3, 4), C'(0, 5)$; Yes
6. (i) (4, -3) (ii) (5, 3) (iii) (-2, -5) (iv) (3, 0) (v) (0, 3)
7. (i) (-4, 3) (ii) (-5, -3) (iii) (2, 5) (iv) (-3, 0) (v) (0, -3)
8. $A'(-4, -3), B'(-2, 5)$; Yes

CHECK YOUR PROGRESS

1. (i) Two (ii) two (iii) none
2. (i) Two (ii) two (iii) three
3. $A'(2, 3), B(-1, -2), C'(0, 2)$; yes 4. (-4, -1), (0, 7), (2, 5)
5. $P'(-3, -2), Q'(7, 4)$ 6. $A'(5, -3), B'(4, 2), C'(-6, -5)$
7. $A'(0, 3), B'(-3, 1), C'(-2, -4), D'(2, -3), E'(4, 1)$

EXERCISE 28.1

1. 40 cm 2. (i) 20 cm (ii) 41 cm
3. (i) 90 cm^2 (ii) 66.15 cm^2 (iii) 5950 cm^2 (iv) 16 cm
 (v) 11 cm (vi) 9.4 cm (vii) 87 cm
4. 30 cm^2 5. (i) 6 cm^2 (ii) 34.56 cm^2
6. $336 \text{ cm}^2; 33.6 \text{ cm}$ 7. (i) 60 cm^2 (ii) 8 cm

8. (i) 9.92 cm^2 (ii) 3.3 cm 9. 15.6 cm^2
 10. 54 cm 11. $62.4 \text{ cm}^2, 10.4 \text{ cm}$ 12. 96 cm^2
 13. (i) 6 cm^2 (ii) 5 cm (iii) 2.4 cm 14. 144 cm^2
 15. 48 cm^2 16. $120 \text{ m}, 100 \text{ m}, 100 \text{ m}$

EXERCISE 28.2

1. (i) 169 cm^2 (ii) 112 cm

Length	Breadth	Perimeter	Area
2.3 m	90 cm	6.4 m	2.07 m^2
2.7 m	85 cm	710 cm	22950 cm^2
15 m	11 m	52 m	165 m^2
9.6 cm	7.4 cm	34 cm	71.04 cm^2
21 cm	17 cm	76 cm	357 cm^2
10.4 cm	8.6 cm	38 cm	89.44 cm^2

3. $32 \text{ cm}; 64 \text{ cm}^2$ 4. (i) 240 cm^2 (ii) 360 cm^2
 5. (i) 96 cm^2 (ii) 875 cm^2 6. ₹ 1638
 7. 122.36 m^2 8. (i) $42 \text{ cm}^2, 46 \text{ cm}$ (ii) $50 \text{ cm}^2; 54 \text{ cm}$ 9. ₹ 9776
 10. ₹ 1460 11. $12 \text{ m}; 2 \text{ m}$ 12. (i) 128 m (ii) 2.5 m
 13. 156 cm^2 14. (i) 252 cm^2 (ii) 245 cm^2

EXERCISE 28.3

1. (i) 3 m^2 (ii) 3.06 m^2 2. 16 cm 3. (i) 24 cm (ii) 120 cm^2
 4. 273 cm^2 5. 66.5 m^2
 6. (i) 65 m^2 (ii) 45.5 m^2 (iii) 19.5 m^2
 7. (i) 182 cm^2 (ii) 46 cm^2 (iii) 46 cm^2
 8. (i) 9 cm (ii) 247.5 cm^2 (iii) 67.5 cm^2
 9. 18.6 cm 10. 128 cm^2
 11. $35 \text{ cm}, 25 \text{ cm}$ 12. $39 \text{ cm}, 42 \text{ cm}$
 13. Base = 14 cm , altitude = 7 cm

EXERCISE 28.4

1. (i) $44 \text{ cm}; 154 \text{ cm}^2$ (ii) $132 \text{ cm}; 1386 \text{ cm}^2$ (iii) $22 \text{ cm}; 38.5 \text{ cm}^2$
 2. 346.5 m^2 3. 8.8 m 4. 40216 km
 5. 14 cm 6. $9 \text{ cm}; 81\pi \text{ cm}^2$ 7. $12 \text{ cm}; 24\pi \text{ cm}$
 8. 105.6 m 9. 50000 10. 94.5 cm^2
 11. 962.5 cm^2 12. 14 cm 13. $77 \text{ cm}, 63 \text{ cm}$
 14. (i) $38 \text{ cm}; 50.75 \text{ cm}^2$ (ii) $88 \text{ cm}; 504 \text{ cm}^2$
 15. $44 \text{ cm}; 42 \text{ cm}^2$ 16. (i) 88 cm (ii) 308 cm^2

CHECK YOUR PROGRESS

1. 98 cm^2 2. ₹ 9450000 3. 27.05 cm^2
 4. Side = 12 cm , altitude = 8 cm
 5. ₹ 2250 6. 18 minutes
 7. $42 \text{ m}; 59.4 \text{ m}$ 8. $119.8 \text{ cm}^2; 11.98 \text{ cm}$

9. (i) 12 cm, 18 cm (ii) 40 cm
 10. (i) 8 cm (ii) 40 cm² 11. 54 cm² 12. 31.4 cm
 13. 88 cm 14. 44 cm 15. 196 cm²
 16. ₹ 20790 17. 1480.5 m² 18. 300%

EXERCISE 29

1. (i) 343 cm³; 294 cm²; 12.12 cm (ii) 91.125 cm³; 121.5 cm²; 7.79 cm
 2. 864 cm²; 1728 cm³ 3. (i) 15.59 cm (ii) 729 cm³
 4. (i) 560 cm³; 412 cm²; 272 cm²; 14.59 cm
 (ii) 945000 cm³; 60600 cm²; 33600 cm²; 188.41 cm
 5. (i) 6 cm; 126 cm²; 8.37 cm (ii) 8 cm; 562 cm²; 18.38 cm
 6. (i) 8 cm (ii) 352 cm² 7. 2560 cm³ 8. 2 m
 9. 4 cm 10. ₹ 11520 11. ₹ 510.39
 12. (i) 450 (ii) ₹ 32400 13. ₹ 756

CHECK YOUR PROGRESS

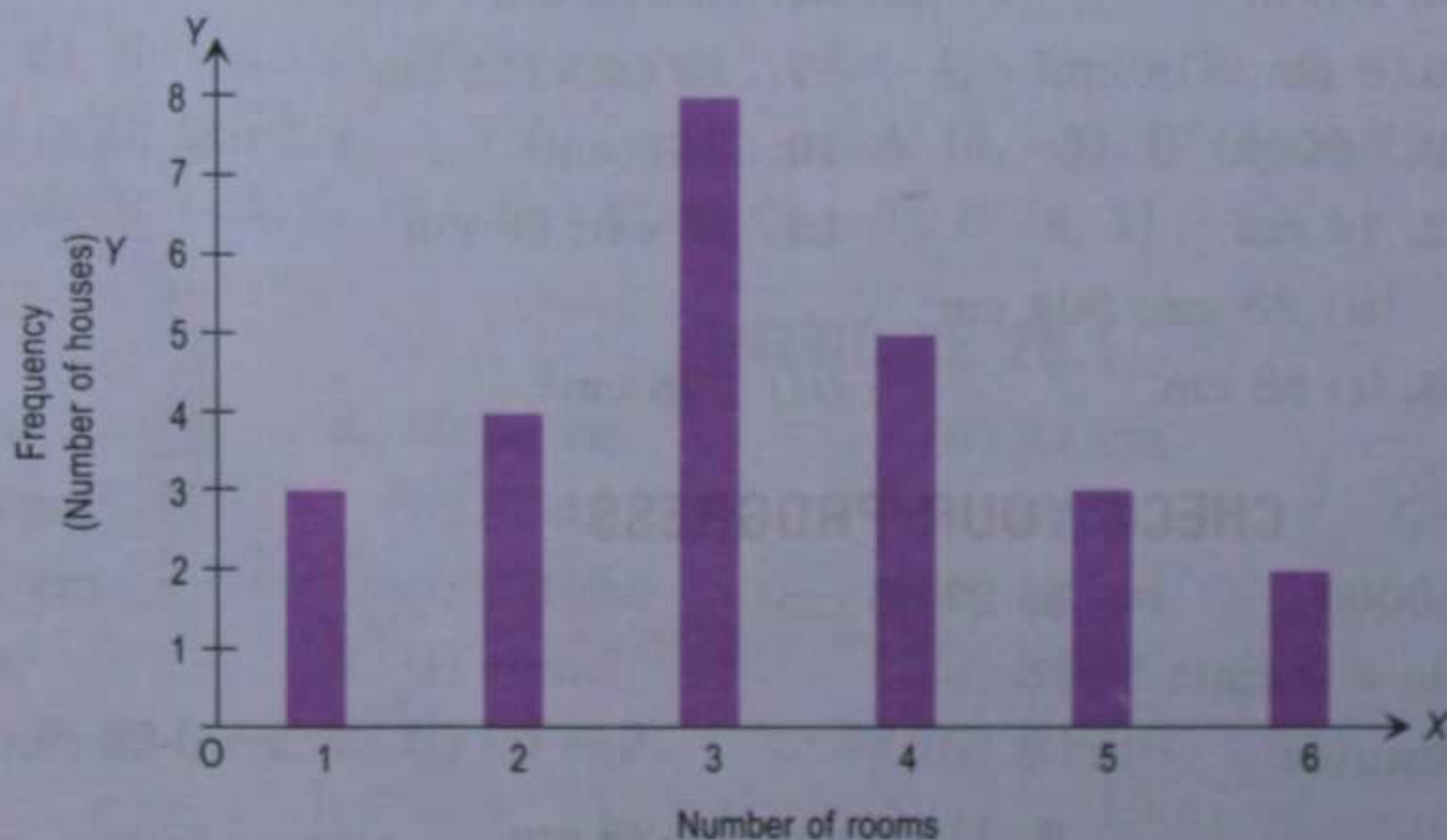
1. (i) 24.25 cm (ii) 2744 cm³ 2. 504000 cm³; 38200 cm²
 3. (i) 8 cm (ii) 448 cm³ 4. ₹ 1350 5. 7.39 cm

EXERCISE 30.1

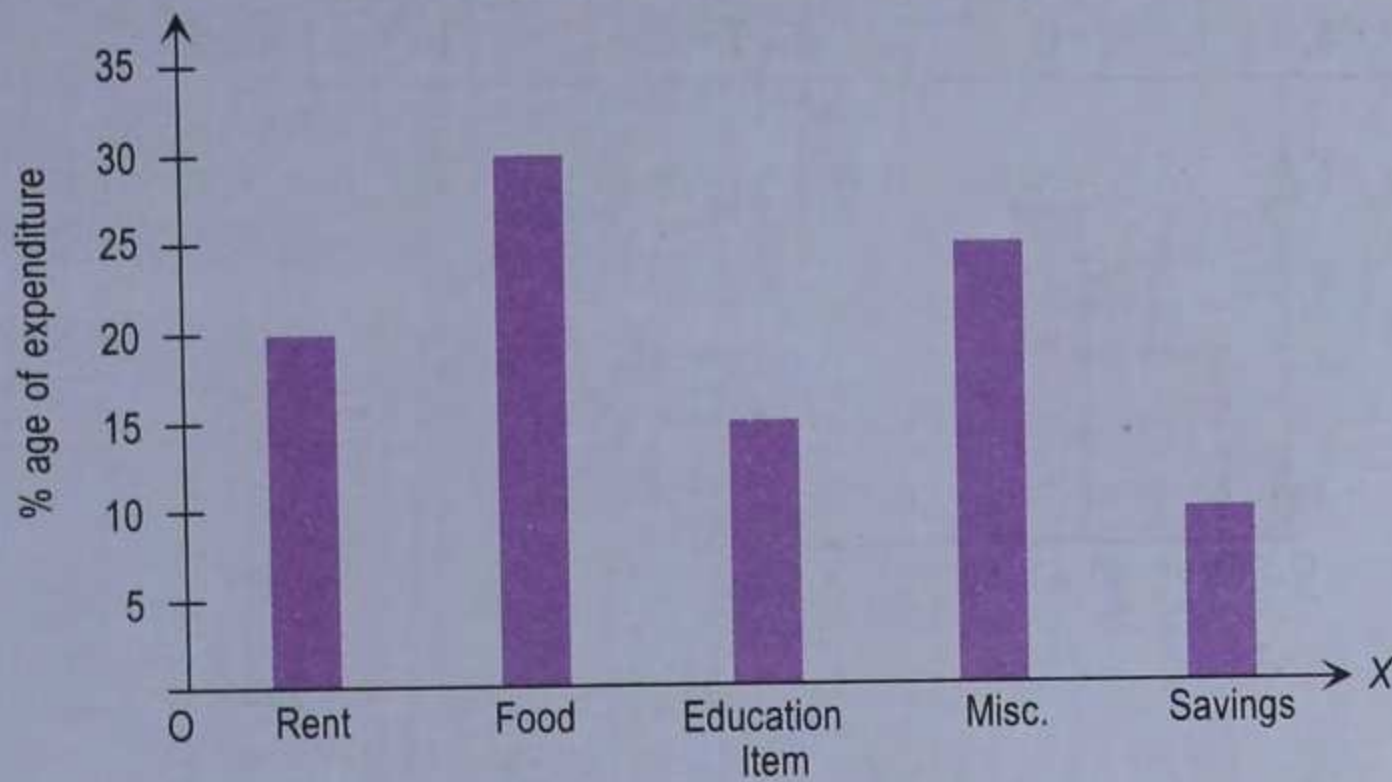
1. (a) 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 6, 6
 (b) The simple frequency distribution table is given below :

Number of rooms (Variate)	Tally marks	Number of houses (frequency)
1		3
2		4
3	≡	8
4	≡	5
5		3
6		2
Total		25

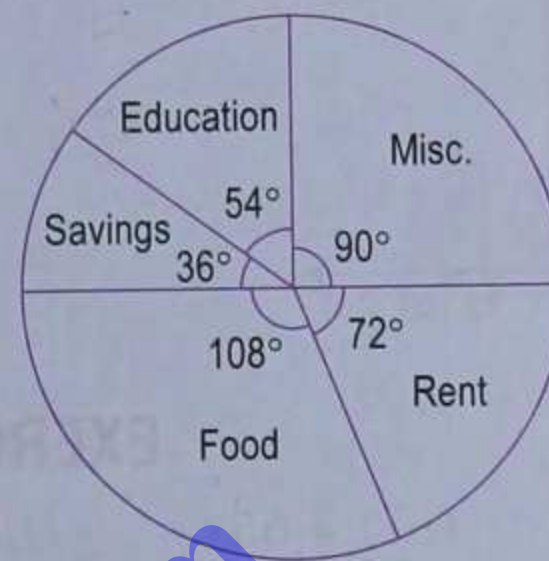
- (c) Column graph showing number of rooms in the houses :



2. (a) Column graph showing monthly expenditure of a family :



(b) Pie chart showing monthly expenditure of a family :



3. P – 1000, Q – 2000, R – 4000, S – 3000

4. (a) Column graph showing population of five major metros of India in 1981



(b) Population of Kolkata was highest because the bar corresponding to it is the highest.

EXERCISE 30.2

1. (a) 3, 6, 10, 12, 14, 15, 17, 20, 23, 25, 27, 28, 28, 30, 35, 37, 37, 37, 38, 40, 40, 40, 41, 42, 48

(b)

Marks	0–10	10–20	20–30	30–40	40–50
Number of students	2	5	6	6	6

(c) 10–20; 10; 10; 20; 15 (d) 30–40; 10; 30; 40; 35

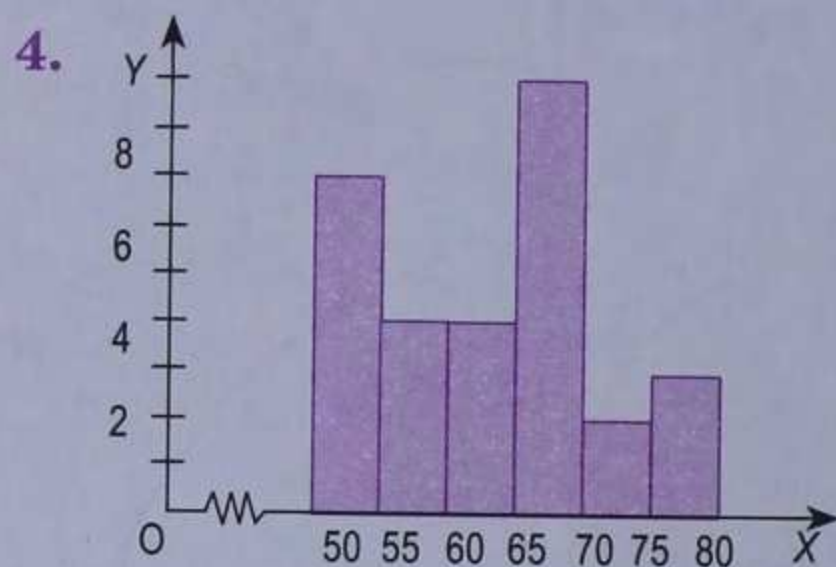
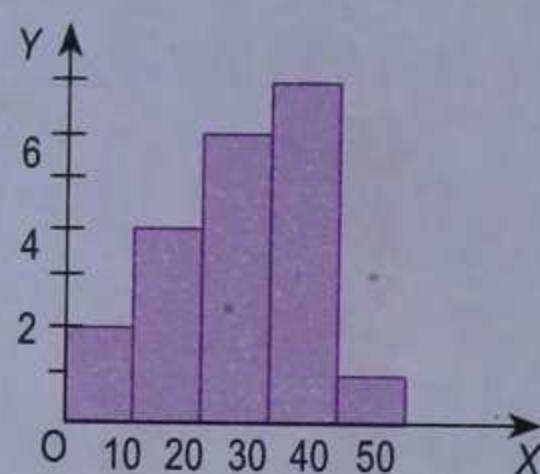
2. (a) 14, 16, 16, 17, 17, 17, 18, 18, 18, 18, 18, 19, 19, 19, 20, 20, 20, 20, 21, 21, 22, 22, 22, 22, 22, 23, 23, 23, 23, 23, 24, 24, 24, 24, 24, 25, 26, 27, 30, 31

(b)

Weight (kg)	10–15	15–20	20–25	25–30	30–35
Number of students	1	13	21	3	2

3.

Marks	0-10	10-20	20-30	30-40	40-50
No. of students	2	4	6	7	1



EXERCISE 30.3

1. (i) 31 (ii) 4 (iii) 4.55 (iv) 35.5
 2. (i) 4 (ii) 4.5 3. (i) 3 (ii) 22
 4. Mean = 2.625, median = 2.5, mode = 3 5. Mean = 3.9, median = 3.5, mode = 3
 6. Mean = 2.9, mode = 4

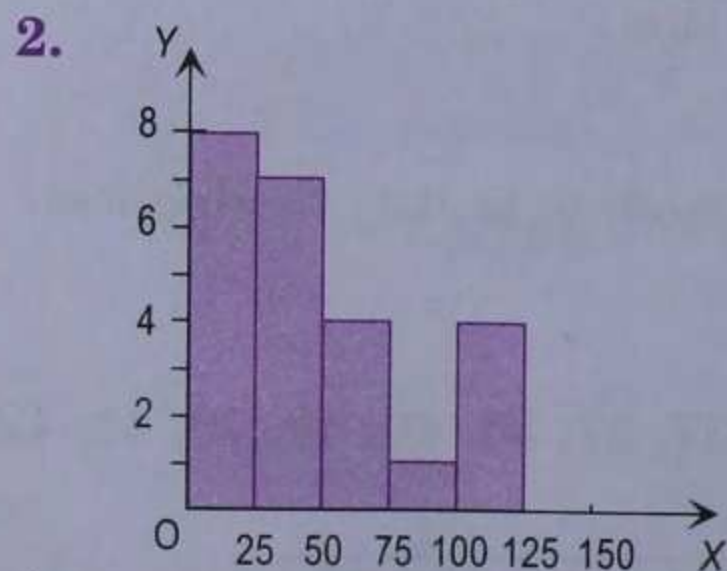
CHECK YOUR PROGRESS

1. (a) 03, 05, 10, 13, 15, 17, 18, 19, 19, 24, 25, 25, 27, 28, 28, 28, 31, 31, 31, 32, 35, 36, 38, 40, 44, 45, 46, 47, 48, 49

(b) Grouped frequency distribution table showing marks obtained by students.

Marks	0-10	10-20	20-30	30-40	40-50
Number of students	2	7	7	7	7

- (c) Third class is 20-30 (d) 20 (e) 30 (f) 10 (g) 25



3. (i) 14 (ii) 15 (iii) 16
 4. 23 5 Mean = 69.18 cm, mode = 69 cm